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International Agreement Report

Assessment of BETHSY Test 9.1.b Using RELAP5/MOD3

Prepared by
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Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
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June 1993

Prepared as part of
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under the International Thermal-Hydraulic Code Assessment
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ICAP

ASSESSMENT OF BETHSY TEST 9.1.b USING RELAP5/MOD3

Abstract

2" cold leg break test 9.1.b, conducted at the BETHSY facility was analyzed using the RELAP5/MOD3 Version 5m5 code.

The test 9.1.b was conducted with the main objective being the investigation of the thermal-hydraulic mechanisms responsible for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure.

The present analysis demonstrates the code's capability to predict, with sufficient accuracy, the main phenomena occurring in the depressurization transient, both from a qualitative and quantitative point of view. Nevertheless, several differences regarding the evolution of phenomena and affecting the timing order have to be pointed out in the base calculation.

Three calculations were carried out to study the sensitivity to change of the nodalization in the components of the loop seal cross-over legs, and of the auxiliary feedwater control logics, and of the break discharge coefficient.

Executive Summary

The BETHSY Test 9.1.b has been analyzed using the RELAP5/MOD3 version 5m5 codes to assess the code's ability for a 2 inch cold leg break LOCA, to improve common understanding of PWR thermal-hydraulic response during such a transient and to identify areas for desirable model improvements based on comparisons between data and predictions.

The main goal of the calculation is the assessment of the simulation capability of the code for the following phenomena occurring during the small break LOCA experimental test, particularly for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure.

The calculated overall trend agreed well with the test data. However, several differences regarding the evolution of phenomena and affecting the timing order have to be point out.

In the base calculation with the RELAP5/MOD3, one can observe three fundamental disagreements between calculated and experimental transient sequences. The first is the overestimation of the calculated break flow rate between 1500 and 2500 seconds leading to an excessive mass discharge from the primary system and therefore from the pressure vessel. This may cause faster depressurization, earlier opening of steam generator steam dump system and earlier accumulator injection compared with the test. The second is the occurrence of loop seal

clearing in the cross-over leg. In the experiment, loop seal clearing occurred in the cross-over leg of the loop 2 (intact), while it occurred first in that of the loop 2 and next in that of the loop 1 (broken) in the present calculation. The third discrepancy of the calculation in comparison with the experiment is the auxiliary feedwater flow rate to each steam generator. In the experiment the auxiliary feedwater flow was controlled by the steam generator narrow range liquid level. This discrepancy may cause the large differences in the steam generator mass inventory.

Three calculations were carried out to study the sensitivity to change of the nodalization in the components of the loop seal cross-over legs, and of the auxiliary feedwater control logics, and of the break flow discharge coefficient. The change of the nodalization into twice than the base case in the cross-over leg resulted in little differences in the transient thermal-hydraulic behavior and its timing order. However the changes of the auxiliary feedwater control logic with steam generator wide range liquid level shows better prediction of the auxiliary feedwater supply. And the change of the break discharge coefficient from 0.85 to 1.0 for the subcooled liquid causes in excessive mass discharge from the break leads to earlier core heatup and earlier opening of SG steam dump system.

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1. Introduction

The International Code Assessment and Application Program (ICAP) has been conducted by fourteen nations and multinational organizations under the auspices of the USNRC[1]. For the pressurized water reactor analysis, the USNRC selected two best estimate (BE) codes: RELAP5/MOD2 and TRAC/PF1/MOD1[2]. The goal of the program is to assess the prediction capabilities of the current BE thermal hydraulic codes utilizing the available facility test and plant data. At present the ICAP activities in Korea help to quantify uncertainties in the codes so that the codes may be used for regulatory purposes.

This report is a part of the Korean contribution to the ICAP. The RELAP5/MOD3[3] Version 5m5 were used in the present calculations simulating the test 9.1.b of the BETHSY facility [4-6].

The main goal of the calculation is the assessment of the simulation capability of the code for the following phenomena occurring during the small break LOCA experimental test, particularly for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure.

The report describes the results of the calculation performed by the RELAP5/MOD3 codes and shows the comparisons with the major variables obtained in the experiment. A brief description of the BETHSY and 9.1.b test is provided in Section 2, and Section 3 describes

the features of the RELAP5 code and modeling to be assessed. Section 4 discusses the results of the base calculations with the RELAP5/MOD3. The motivations for the sensitivity and nodalization studies and their results are included in Section 5. The code efficiency is evaluated in Section 6 through run statistics. The conclusions drawn from this study are given in Section 7.

2. Facility and Test Description

2.1 Facility Description

The BETHSY integral test facility has been designed for the analysis of PWR accident situations controlled by automatic circuits and/or operator actions.

The main objectives of the BETHSY test program are to contribute to:

- improve the knowledge of the physical phenomena which occur during PWR accidents, particularly when two-phase flow takes place at the primary coolant system
- assess safety computer codes, especially the advanced code CATHARE
- validate the physical assumptions of event and state oriented Emergency Operating Procedures.

2.1.1 General design

BETHSY is designed to model a 3 loop - 2775 MWt - Framatome PWR as shown in Fig. 1. The overall scaling factor is 1/100 while the elevations are 1/1, and the design pressures are 17.2 MPa and 8 MPa for the primary and the secondary coolant systems which can play a role during an accident transient.

2.1.2 Main characteristics

i) Pressure vessel

The cylindrical core consists of 428 full length - 17 x 17 design - heater rods and 29 guide thimbles. The axial peaking factor is 1.5 and the radially uniform core power is up to 3 MW (i.e. about 10% of the scaled nominal value).

The core bypass is represented and the external downcomer is linked to the upper head through calibrated orifices in order to simulate the downcomer to upper head spray nozzles.

ii) Primary coolant piping and pumps

BETHSY has the same number of loops as the reference reactor. The inner diameter of all the piping is 118mm as given by the Froude number conservation applied to the hot legs, and the elevation of the horizontal part of the crossover leg is preserved. The primary coolant pumps are capable of delivering the nominal flow rate but have also a controllable rotation speed in order to obtain, when necessary, both the right initial energy distribution at the primary side and to simulate the pump coastdown. The elevation of the pump diffuser with respect to the cold leg is preserved.

iii) Pressurizer

Connected either to an intact or broken loop, the pressurizer is equipped with on-off and proportional heaters, the normal and the auxiliary spray systems, a relief circuit with adjustable setpoints and

relief capacity.

iv) Secondary coolant system

Each of the three steam generators includes 34 U-tubes of the same radial dimensions and height stepping (9 to 10.5 m) as in the reference steam generators, and so arranged that the hydraulic diameter of the secondary side is preserved and the tube lane is true to scale.

The main and auxiliary feedwater systems can operate at adjustable flow rate and temperature, and the steam system in particular includes isolation valves and steam dumps to the atmosphere or to the condenser (adjustable setpoints and relief capacities).

v) Safety injection systems

All the emergency core cooling systems (HPIS, accumulators, LPIS) are represented and BETHSY is designated for ECC water to be injected not only in the cold legs but also at other locations such as the hot legs, the top of the downcomer, the lower and the upper plenum. HPIS and LPIS flow rates are controlled by the primary coolant system pressure so as to obtain scaled flow rates at every time.

Three volume scaled accumulators pressurized with nitrogen can supply the primary coolant system with room temperature water at a pressure up to 7 MPa.

vi) Trace Heating

The primary coolant system and the steam generators are equipped with trace heaters in order to compensate for the heat losses which are never to scale on an integral test facility and which could distort certain phenomena especially in steady state conditions or along slow transients.

vii) Instrumentation

Detailed information on thermal-hydraulic phenomena which take place both at the primary and secondary side is provided by more than 1200 transducers whose signal is scanned at a sampling rate of 2 Hz.

viii) Control system

The BETHSY control system - distributed microcomputer type - enables the facility to be operated from three operator stations and is designed for an automatic control of sequences (simulation of automatic reactor systems and operator actions).

2.2 Test Description

The test 9.1.b belongs to the multiple failure transient category, and is involved in accident management studies : it consists in a 2" cold leg break, while high pressure safety injection system (HPIS) is assumed unavailable. This transient leads to a large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure.

In the presently studied scenario, the start of the procedure is delayed, and the following trigger criterion is used : when the maximum heater rod cladding temperature reaches 450 C, the 3 steam generator steam dump to atmosphere are fully opened (condenser is unavailable).

This action allows the primary coolant circuit to depressurize, up to the accumulator injection threshold, then to LPIS actuation.

The end of the test is reached as soon as a safe state of the primary coolant circuit is recovered, i.e. when the conditions required for the actuation of the residual heat removal system are obtained.

3. Code and Modeling Description

3.1 Code Description

The RELAP5/MOD2 code has been developed for best-estimate transient simulation of PWRs and associated systems. The code is based on a non-homogeneous and non-equilibrium model for one dimensional, two-phase system that is solved by a fast, partially implicit numerical scheme to permit economical evaluation of system transients. Recently, the RELAP5/MOD3 code development program has been initiated to develop a code version suitable for the analysis of all transients and postulated accidents in PWR systems including both large and small break LOCAs as well as the full range of operational transients. Although the emphasis of the RELAP5/MOD3 development is on large break LOCA, improvements to existing code models, based on the results of assessments against small break LOCA and operational transient test data, are also being made.

In the present assessment the RELAP5/MOD3 Version 5m5 was used.

3.2 Modeling Description

The nodalization used to simulate the BETHSY Test facility with the RELAP5 code is shown in Fig. 2. The model is based on 261 volumes

connected by 272 junctions and 263 heat structures.

In the reactor vessel element (volumes 11 to 22) the volumes corresponding to the downcomer, the lower plenum, the core, the upper plenum, the upper head, the guide tubes, and the downcomer bypass are defined. The core is modeled by one channel arranged in 7 hydraulic volumes, in which only one series of heat structures is adopted to simulate the fuel assembly.

The three loops of the BETHSY system are represented by the two intact loops (volumes 41 to 59) and the broken loop (volumes 31 to 39) in an almost symmetrical way. In fact, each of the three loops present the hot leg, the SG inlet and outlet plena, the SG U-tube channel, the loop seal, the reactor coolant pump, the cold leg. In addition, the pressurizer is connected to the broken loop hot leg by means of the surge line element and the break system is connected to the broken loop cold leg.

In the volumes representing the pressurizer vessel, an additional heat structure is introduced to simulate the effects of the proportional and back-up heaters.

The three steam generator secondary sides (volumes 60 to 89) are simulated using an identical schematization. They can be subdivided into the downcomer, the boiling section, and the steam dome. The steam and feedwater lines are simulated by using Time Dependent Junctions (i.e. with imposed flow rates) because they must be excluded during the transient phase of the calculation. In fact, in the experimental

test, the two mentioned lines are closed in coincidence with the reactor scram signal, few seconds after break opening, to isolate the SG secondary side. Steam dump systems are also connected to the SG steam dome using Time Dependent Junction in which the operational setpoints and conditions are specified to be the same as the experiment.

The steam generators as well as the pressurizer are provided with two systems devoted to the control of the pressure and the liquid level during the steady-state period and to maintain them at the specified initial values.

The physical boundaries of the entire system, i.e., the reactor containment and the relief and safety discharge tanks, are reproduced by means of Time Dependent Volumes with constant internal conditions during the calculation.

On the BETHSY loop, heat losses are compensated by electrical trace heating, located on every component and piping of the primary coolant system (except downcomer to upper head bypass, pumps, hot and cold legs spool pieces), and the steam generators (except their external downcomers). This trace heating system was compensated by modeling the heat structure surfaces as insulated boundaries.

To allow the accumulator injection to start correspondingly to the cold leg pressure specified in the experiment, a valve is arranged on each of the accumulator surge lines.

The choked flow option is specified in the valve simulating the

break and to avoid the code calculating mass flow rates to be inconsistent with the experimental data, the subcooled and two-phase discharge coefficients are chosen as 0.85 and 1.0, respectively.

4. Base Calculations

A major safety issue in PWR design is the Loss-of-coolant accident, in which a break in the primary coolant circuit leads to depressurization, boiling of the coolant, consequent reduced cooling of the reactor core, and unless remedial measures are taken, overheating of the fuel rods. The control of LOCAs in PWR is in general considered to be ensured by existing ECCSs and by the secondary side of the steam generators as additional heat sink in particular for small break LOCAs.

In the present study the RELAP5/MOD3 code was used for the base calculations and their results are shown in the figures from 3 to 68.

The calculated results for the principal events are compared with the experimental values in Table 3. All the major phenomena observed during the experiment were reproduced by the code.

i) Primary and Secondary Pressures

Fig. 3 and Fig. 4 show the primary and secondary pressures in comparison with the experimental values. The code predicts well the primary and secondary pressure trend, whereas, despite a good qualitative agreement, it highlights some differences in the behavior of the primary and secondary depressurization in the region between 2000 and 2500 seconds due to earlier opening of steam dump systems than experiment.

When the RCS pressure reaches the hot leg saturation pressure at

about 7.5 MPa boiling appears in the upper head, the upper plenum and the hot legs. The upper head draining is complete at about 1000 seconds and the upper plenum level reaches the hot leg nozzle as shown in Fig. 5 and Fig.6, respectively. At this time two-phase natural circulation is settled, and the RCS pressure drops to 7.25 MPa. The primary pressure depressurization became slower after flashing started in the primary loop hot side. The primary pressure remained higher than the secondary pressure all through the transient.

From 900 to 1700 seconds the mixture level in the downcomer and in the core remains fairly constant as shown in Fig. 7. At 1770 seconds the water level in the downflow side of the loop seal cross-over leg is such that a manometric unbalancing is built between hot and cold legs. This pressure difference leads to a liquid level depression in the pressure vessel which causes the mixture level drop below the hot leg elevation.

ii) Break Flow Rate

Fig. 8 and Fig.9 show that the break flow rate is well reproduced by the code with the break discharge coefficient of 0.85 and 1.0 for subcooled liquid and two-phase flow, respectively. However the calculated break flow rate between 1500 and 2500 seconds leads to an excessive mass discharge from the primary system and therefore from the pressure vessel. This may cause faster depressurization, consequently earlier opening of steam generator steam dump system and earlier

accumulator injection compared with the test as shown in Figs. 10 to 12.

iii) SG U-tube differential Pressure

Figs. 13 to 21 show the differential pressures in SG U-tubes, inlet plenum, upflow and downflow side. The agreement between measured and calculated data is acceptable concerning the downflow side, but the weak liquid holdup in the upflow side of the SG U-tubes was observed particularly in loop 1.

iv) Loop Seal Cross-over Legs

In the experiment, loop seal clearing occurred in the cross-over leg of the loop 2 (intact), while it occurred first in that of the loop 2 and next in that of the loop 1 (broken) in the present calculation as shown in Figs. 22 to 27. The reason for this behavior are not yet well understood. Possible geometrical discrepancies have been checked on BETHSY : no differences in elevation larger than 1 cm were observed between 3 loops (loop seal + cold leg). A temperature differences as small as 2 C between intermediate legs could result in the same $\pm$ cm discrepancy on the liquid level in the downflow side, and lead to asymmetrical loop seal clearing [7]. It is particularly noticeable that during the two other 2' cold leg break test performed on BETHSY (Test 4.2a), loop seal clearing was observed first on the broken loop 1 then on the other intact loop 3 [8].

v) Core Thermal-Hydraulic Responses

The differential pressures in the core and the upper plenum are presented in Fig. 28 and Fig. 6 respectively, in which the code achieves a good simulation of the core level depression. One can observe, however, that the first core uncovery and consequent recovery occurred at about same time, whereas the second core level depression is anticipated earlier about 100 seconds. The reason for this behavior resides in the simultaneous occurrence of several effects. The duration of the first core heatup, associated with loop seal clearing, was almost identical. However it is considered that the first loop seal clearing occurred partially in loop 2 and the faster linear depressurization predicted by the calculation after loop seal clearing lead to an early second core uncovery and to the anticipated vessel mass inventory boil-off.

The core level was depressed manometrically, concurrently with the level drop in cross-over legs, and took a minimum immediately before the loop seal clearing started. This minimum core level was lower than the cross-over leg liquid level which was at the bottom of the leg.

Fig. 29 and Fig. 30 show rod surface temperatures at the average-power bundles. The core liquid level depression resulted in rod temperature excursions starting from about 2200 seconds. The peak cladding temperature was about 1075 K (vs. 1000 K in the experiment) for the average-powered bundles as shown in Fig. 31. After the loop seal clearing, the core liquid level recovered quickly and heater rods

were quenched.

vi) Transient Behavior of Other Variables

The transient behavior of the other variables are shown in Figs. 32 to 68. The variables, such as void fractions, flow rates, pressure differences, and fluid temperatures in the primary and secondary loops, etc., were in good agreement with the experiment.

However a large discrepancy occurred in the SG auxiliary feedwater flowrate and SG mass inventory as shown in Fig. 32 and Fig. 33. The calculated auxiliary feedwater flowrate was generally underpredicted with large fluctuation. During the calculation the auxiliary feedwater flowrate was controlled by the SG narrow range liquid level same as the experiment. This discrepancy may cause the large differences in the SG mass inventory, whereas, it didn't affect much in the primary system transient.

After the accumulator injection into two intact loops, calculated accumulator inject flowrate was larger than the test and this may cause the depletion of the mass inventory in the accumulator tank before reaching the accumulator isolation set point (1.5 MPa) as shown in Fig. 11 and Fig. 12. Moreover, the requiring CPU time highly increases (i.e., about 10 times longer than before the accumulator injection) to proceed to the next step since the time step size is too small. The identical problem has been occurred after the Low Pressure Safety Injection, therefore the calculation was terminated by the user due to

requiring too much CPU time.

5. Sensitivity and Nodalization Studies

The base calculations agreed well with the test data. However the timing order of the principal phenomena, the loop seal clearing and refilling, and the auxiliary feedwater flowrate has to be pointed out.

5.1 Sensitivity

In Figs. 69 to 80 the results from the change of the auxiliary feedwater control logic and of the break discharge coefficient are represented as "CALC:AUX" and "CALC:CD1.0" respectively.

i) Auxiliary Feedwater Control Logic

In the experiment the auxiliary feedwater flowrate was controlled by the SG narrow range liquid level. However the results from the base calculation showed that the underprediction of the auxiliary feedwater flowrate and large difference in SG mass inventory. Thus the auxiliary feedwater control logic is now changed from the SG narrow range liquid level into the wide range liquid level. The results shows that the nearly identical auxiliary feedwater flowrate to the test is observed even with relatively larger SG mass inventory than the test as shown in Fig. 69 and Fig. 70.

ii) Break Flow Discharge Coefficient

In the base calculation the break discharge coefficient for the subcooled liquid was 0.85. In order to take a look at the effects of this coefficient the break discharge coefficient of 1.0 is used. As is to be expected larger coefficient shown in Figs. 71 to 76 leads to an excessive mass discharge from the primary system and this may cause faster depressurization, earlier opening of the SG steam dump system, and earlier accumulator injection.

As shown in Figs. 77 to 80 the occurrence of the loop seal clearing was only on the loop 1 (broken). Therefore it may be considered that the occurrence of the loop seal clearing is dependent not only on the break flowrate but also on the flow resistance of the loop seal cross-over legs which would determine the vapor flow partition among the loops. The detailed reason for this behavior are not jet well understood.

5.2 Nodalization

In the base calculation the loop seal clearing and refilling have occurred as is observed in the test, however the complete loop seal clearing was not appeared in the intact loop 2 and the second loop seal clearing was appeared in the broken loop. This was different from the test which was observed in the intact loop only. Therefore the

nodalization may be necessary to evaluate the effectiveness of the nodalization and to quantify their effects on the loop seal behavior. In this calculation the number of the volumes increased twice than the base case, particularly in the three loop seal cross-over legs. The calculated results shows no differences in predicting the loop seal clearing and refilling behavior. Thus it is expected from this that the nodalization in the base calculation was sufficient to predict this phenomena.

6. Run Statistics

CRAY2S/4-128 for calculation using RELAP5/MOD3 Code was used. The size of the time step was chosen to be 10E-6 and 10E-1 seconds at the minimum and the maximum time step, respectively, for all calculations. During the calculation the water property errors were occurred about at 2585 seconds. Therefore, restart calculation with reduced time step of 0.05 seconds were applied for the next 50 seconds to overcome this. It is also noted that the required CPU time vs the transient time is extremely increased by about 5 to 10 times just after the accumulator injection to cold legs have started. Similar trend occurred when the Low Pressure Safety Injections have started.

The computational efficiency is summarized in Table 4 from the major edit for base calculations and can be obtained as follows.

Calculation	Computer Time (CPU),sec	Number of Time Step (DT),	Number of Volume (N)	Grind Time CPU/(N*DT)
RELAP5/MOD3	27271.3	151456	261	0.000689

7. Conclusions

The BETHSY Test 9.1.b has been analyzed using the RELAP5/MOD3 version 5m5 codes to assess the code's ability for a 2 inch cold leg break LOCA, particularly for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure, to improve common understanding of PWR thermal-hydraulic response during such a transient and to identify areas for desirable model improvements based on comparisons between data and predictions.

The present study demonstrates the code's capability to predict, with sufficient accuracy, the major phenomena occurring in the depressurization transient, both from a qualitative and quantitative point of view. In addition, it was shown that the actuation of accumulator and LPSI resulting from RCS depressurization through SG steam dump could be an effective means to mitigate the accident with above initiating event.

Based on this result, analyses of the various sequences of events may provide an useful information on the implementation of an ultimate procedure for accident mitigation and be used to validate the physical assumptions of Emergency Operating Procedures.

References

1. Guidelines and Procedures for the International Code Assessment and Applications Program, NUREG-1271, April 1987.
2. U.S. Regulatory Commission Compendium of ECCS Research for Realistic LOCA Analysis, NUREG-1230, May 1987.
3. "Appendix A RELAP5 Input Data Requirements," EG&G Idaho Inc.,1990.
4. "BETHSY General Description," Note SETh/LES/90-97, April 1990.
5. Gully, Ph. and Deruaz, R.,"BETHSY Measurement System," Note SETh/LES/87-27, Oct. 1987.
6. Bazin, D.,"BETHSY : Data Base," Note SETh/LES/87-28, March 1988.
7. Chataing, T. and Clement, T.,"2" Cold Leg Break Without HPSI and With Delayed Ultimate Procedure," Note SETh/LES/90-104, June 1990.
8. Bazin,P. et al,"Investigation of PWR Accident Situations at BETHSY Facility," Nuclear Engineering and Design, Vol. 124, pp. 285-297,1990.

Table 1. Specified Operational Setpoints and Conditions
For BETHSY Test 9.1.b

Reactor Scram Signal	13.1 MPa
Safety Injection (SI) Signal	11.9 MPa
Core Power Trip Starts	17 sec After Scram Signal
Initiation of RC Pump Coastdown	300 sec After Scram Signal
High Pressure Charging	Not Actuated
High Pressure Safety Injection	Not Actuated
Main feedwater termination	With SI Signal
Turbine Bypass Valve Closure	With SI Signal
Auxiliary Feedwater Starts	30 sec After SI Signal
Full Opening of 3 Steam Dumps To Atmosphere	At Max. Core Cladding Temperature of 450 C
Accumulator Injection (2 Intact Loops Only)	4.18 MPa
Accumulator Termination	1.5 MPa
Low pressure Safety Injection (2 Intact Loops Only)	0.91 MPa
Stable RHR Operating Conditions Prevails (Termination of Transient)	Core Outlet Temp. < 177 C PZR Pressure < 2.5 MPa Saturation Margin > 20 C

Table 2. Comparison of Initial Conditions

Parameter	Units	Measured	Calculated
PRIMARY LOOP			
Core Differential Temperature = (Hot-Leg Temperature) - (Cold-Leg Temperature)	K	3.58	3.49
Hot-Leg Pressure	MPa	15.51	15.55
Hot-Leg Temperature	K	563.3	564.8
Mass Flow Rate Per Loop	kg/s	50.0	51.1
Pump Differential Pressure	MPa		0.476
Pump Rotational Speed	rpm	2940	2808.8
PRESSURE VESSEL			
Core Power	kW	2587	2587
Core Differential Pressure	MPa		0.1313
Upper Head Temperature	K		561.3
Lower Plenum Temperature	K		561.3
Core Inlet Temperature	K	559.8	561.3
PRESSURIZER			
Pressure	MPa	15.51	15.51
Liquid Level	m	4.08	4.00
Liquid Volume	m3		0.407
Vapor Volume	m3		0.273
Temperature (Bottom)	K		599.5
Primary System Total Mass Inventory	kg	1960	1948.8
Primary System Total Volume	m3		2.86
SECONDARY SYSTEM			
SG Steam Dome Pressure	MPa	6.91	6.91
Steam Flow Rate	cm3/s	620	620
Feedwater Flow Rate	cm3/s	620	620
Feedwater Temperature	K	491.1	491.1
Downcomer Water Level	m	13.45	13.43
Secondary Side Mass Inventory For Each SG	kg	820	820.0
Secondary Side Total Volume	m3	6.0615	6.062

Table 2. Comparison of Initial Conditions

Parameter	Units	Measured	Calculated
EMERGENCY CORE COOLING SYSTEM			
Accumulator Pressure	MPa	4.18	4.18
Accumulator Liquid Temperature	K	290	290
Accumulator Liquid Volume	m3	0.286	0.286
Accumulator Gas Volume	m3	0.137	0.137
EXTERNAL CIRCUITS			
Trace Heating	kW	107.5	
Pump Connected Cooling Circuits	kW	25	25

Table 3. Chronology of Main Events

(Unit : Second)

	Measured	Calculated
Transient Initiation	0	0
Scram Signal (P=13.1 MPa)	41	32
Pressurizer Empty	50	60
Safety Injection Signal Generated (P=11.9 MPa)	54	58
Main Feedwater Off	54	58
Turbine Bypass Valve Closure	54	58
Core Power Decay Starts 17 s After Scram Signal	58	49
Auxiliary Feedwater On (30 s After SI Signal)	82	88
Voiding Appears in Hot Leg 1	126	125
Pump Coastdown Starts 300 s After SI Signal	356	358
End of Pump Coastdown	971	973
Start of the First Core Uncovery	1830	1850
First Loop Seal Clearing in Loop 2	1944	1995
Start of the Second Core Uncovery	2180	2080
Ultimate Procedure Initiation (Max. Core Cladding Temperature Reaches 450 C)	2562	2503

Table 3. Chronology of Main Events

(Unit : Second)

	Measured	Calculated
Atmospheric Steam Dump Opening (3 SG) in 5 s	2567	2503
Loop Seal Reformation in Loop 2	2750	2525
Accumulator Injection Starts (P=4.2 MPa)	2962	2803
Minimum Primary Mass Inventory (400 kg)	2970	2805
Second Loop Seal Clearing in Loop 2	3040	2965 *
Loop Seal Reformation in Loop 2	3680	3555 *
Accumulator Isolation (P=1.5 MPa)	3831	3525
LPIS Starts at P=0.91 MPa (On Intact Loop Only)	5177	5015
End of the Test (RHRS Stable Operating Conditions Are Reached)	8330	5245 **

* : Appeared in Loop 1 (broken)
** : Calculation terminated by user due to requiring too much CPU time

Table 4. Run Statistics Data in Base Case

Transient time (sec)	CPU Time (sec)	Attempted ADV
0	4.4	0
500	2069.5	12478
1000	3571.2	20790
1500	5177.8	29597
2000	8102.8	45865
2500	8737.6	49511
3000	10031.5	56627
3250	10149.2	63043
3500	18521.9	103696
4000	23737.5	132438
4500	25431.3	141517
5000	27271.3	151456

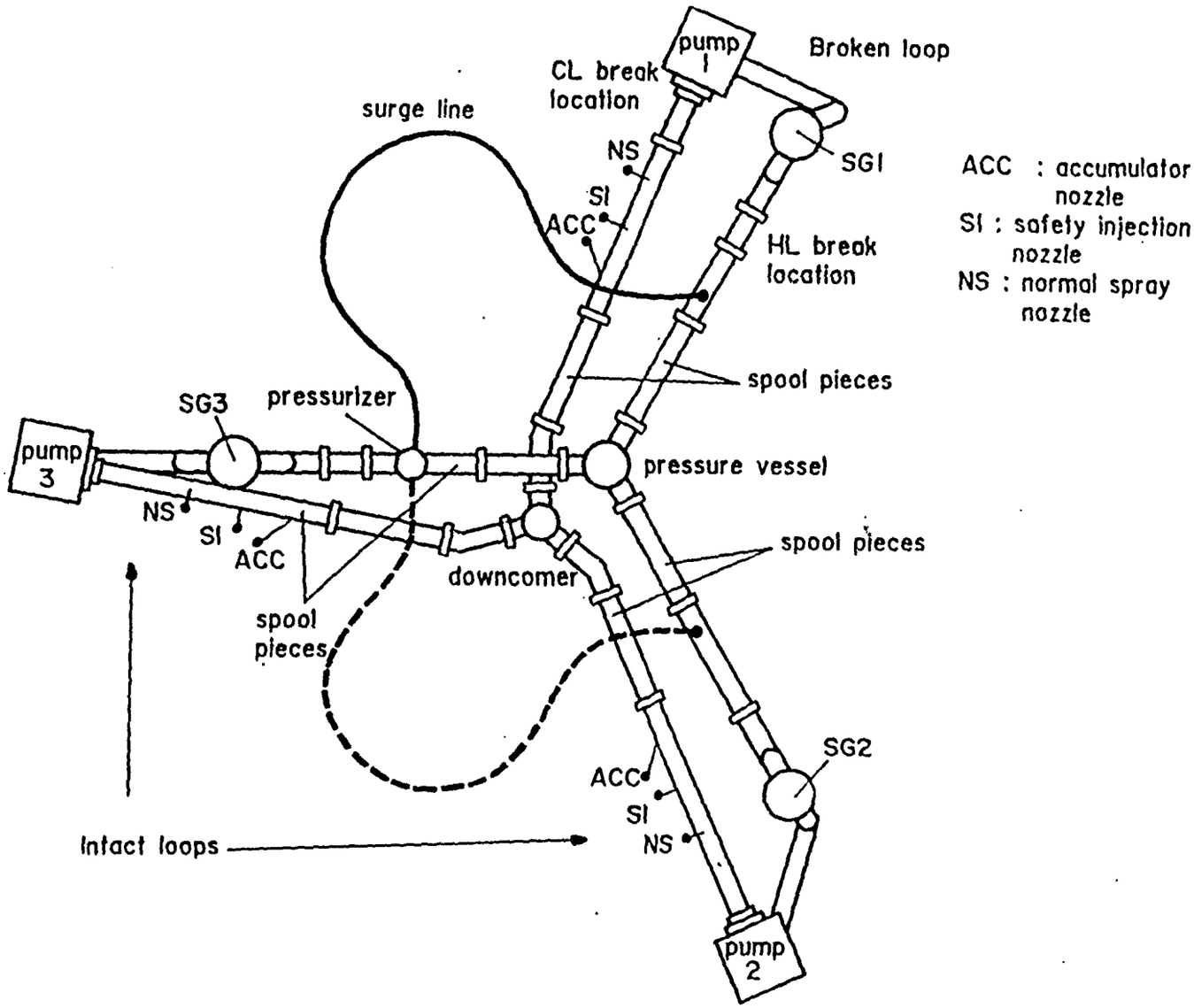

Fig. 1 General Structure of BETHSY Test Facility

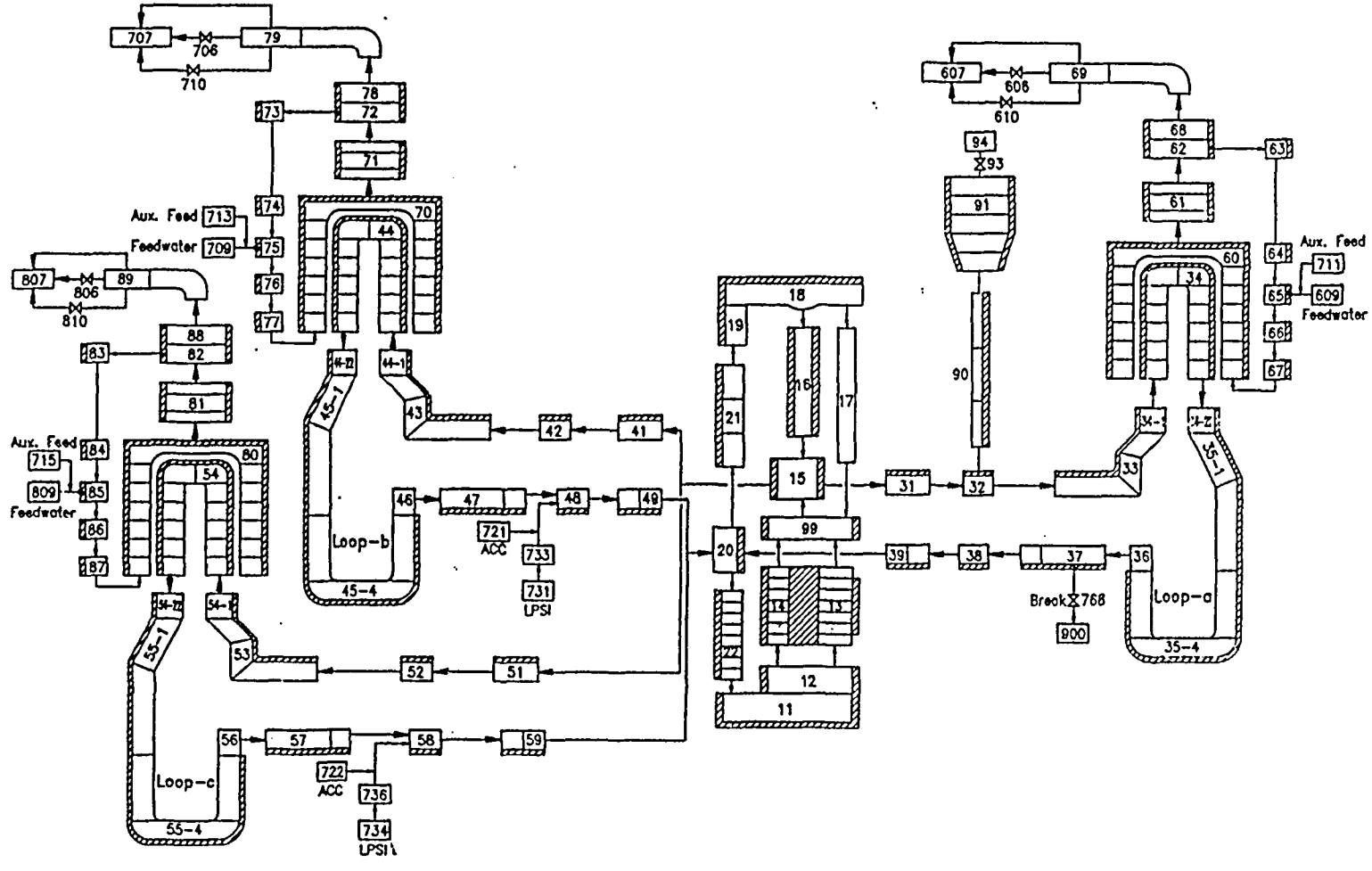

Fig. 2 Nodalization of BETHSY for RELAP5/MOD3 Code

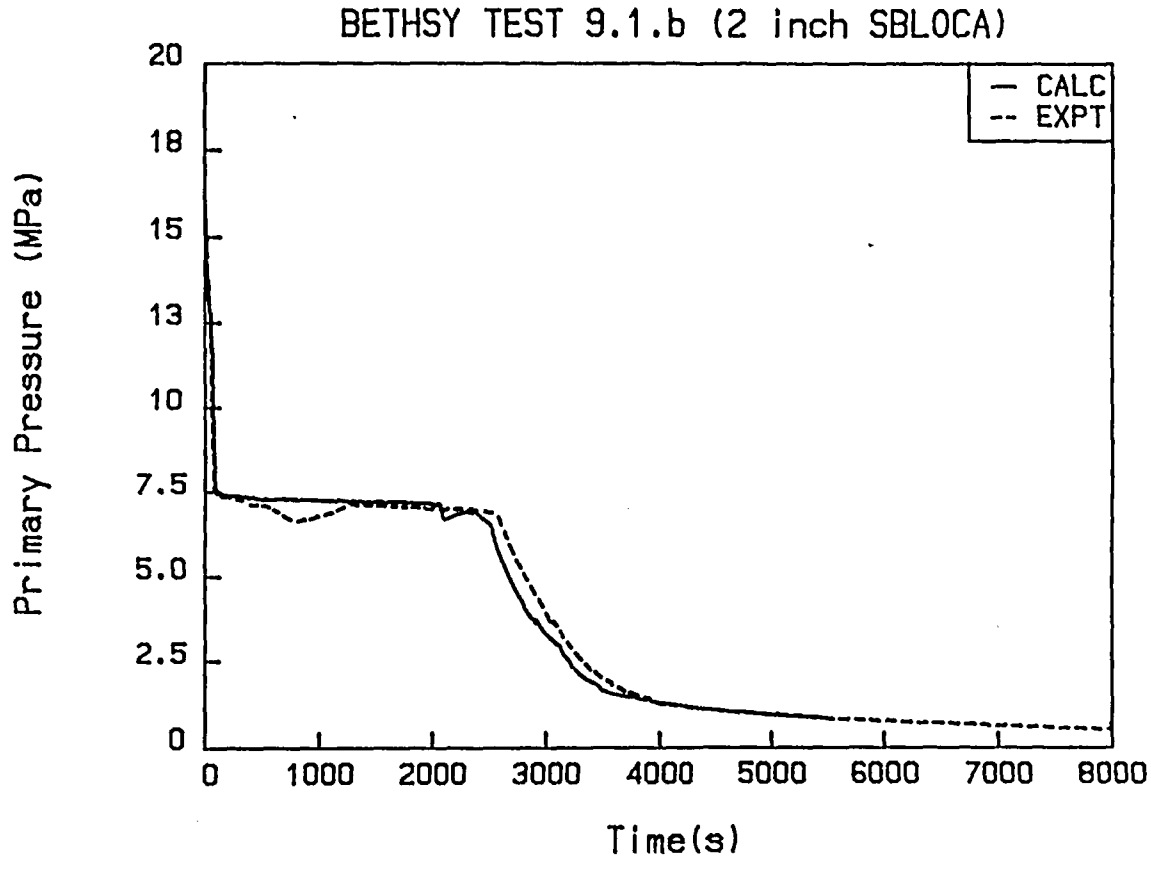

Fig. 3 Primary Pressure

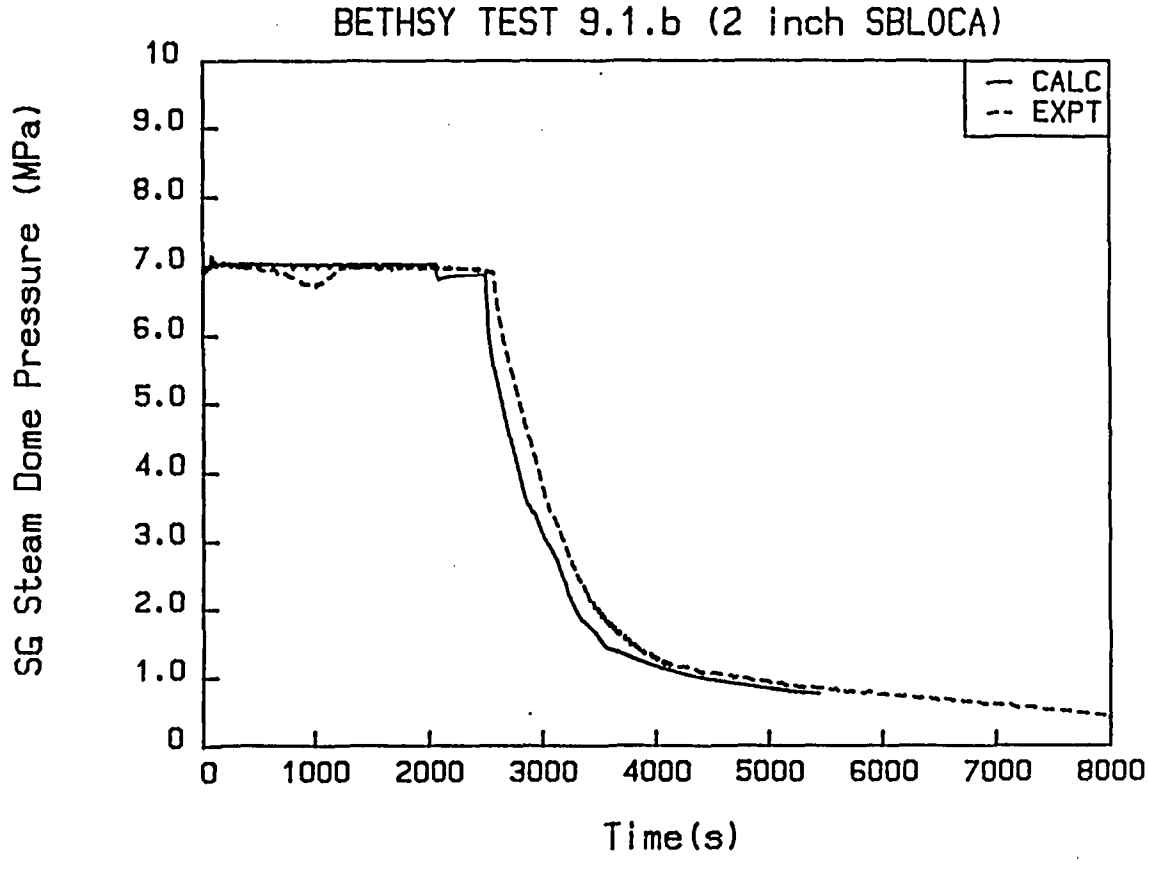

Fig. 4 SG Steam Dome Pressure

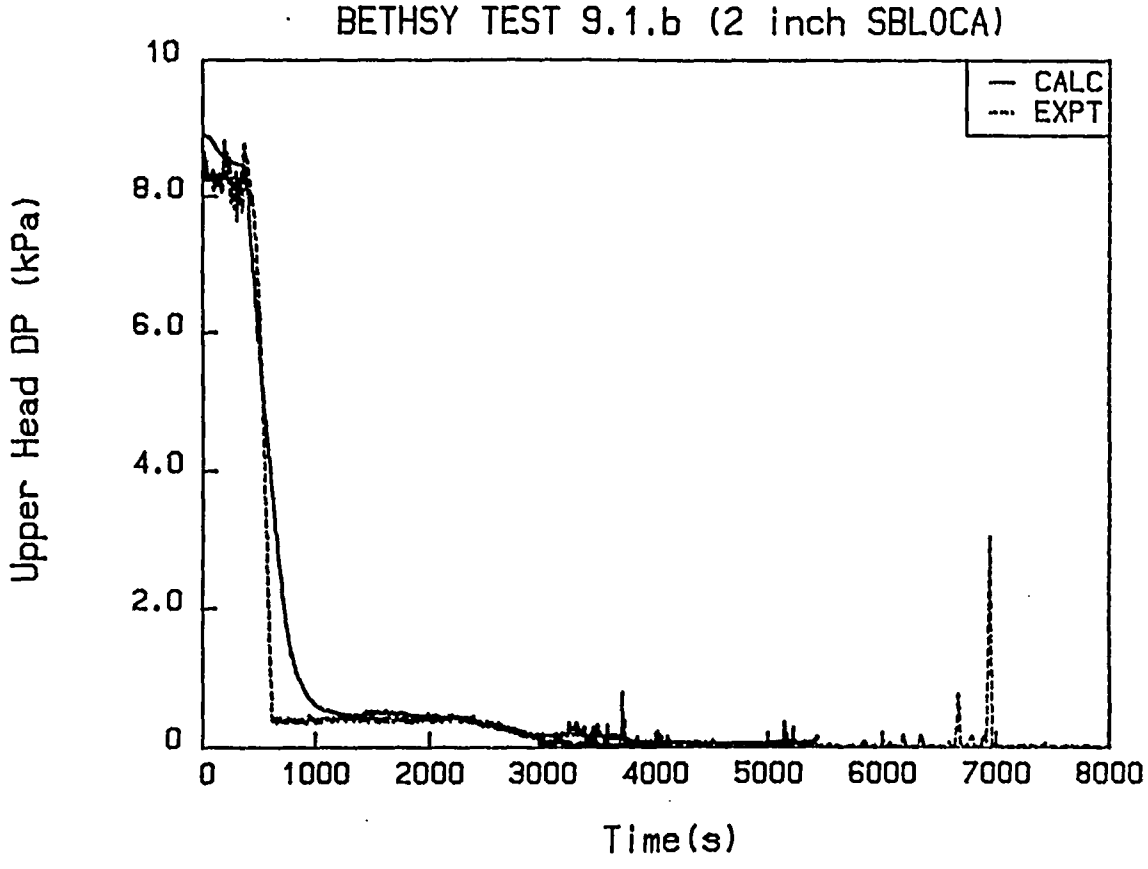

Fig. 5 Upper Head Diff. Pressure

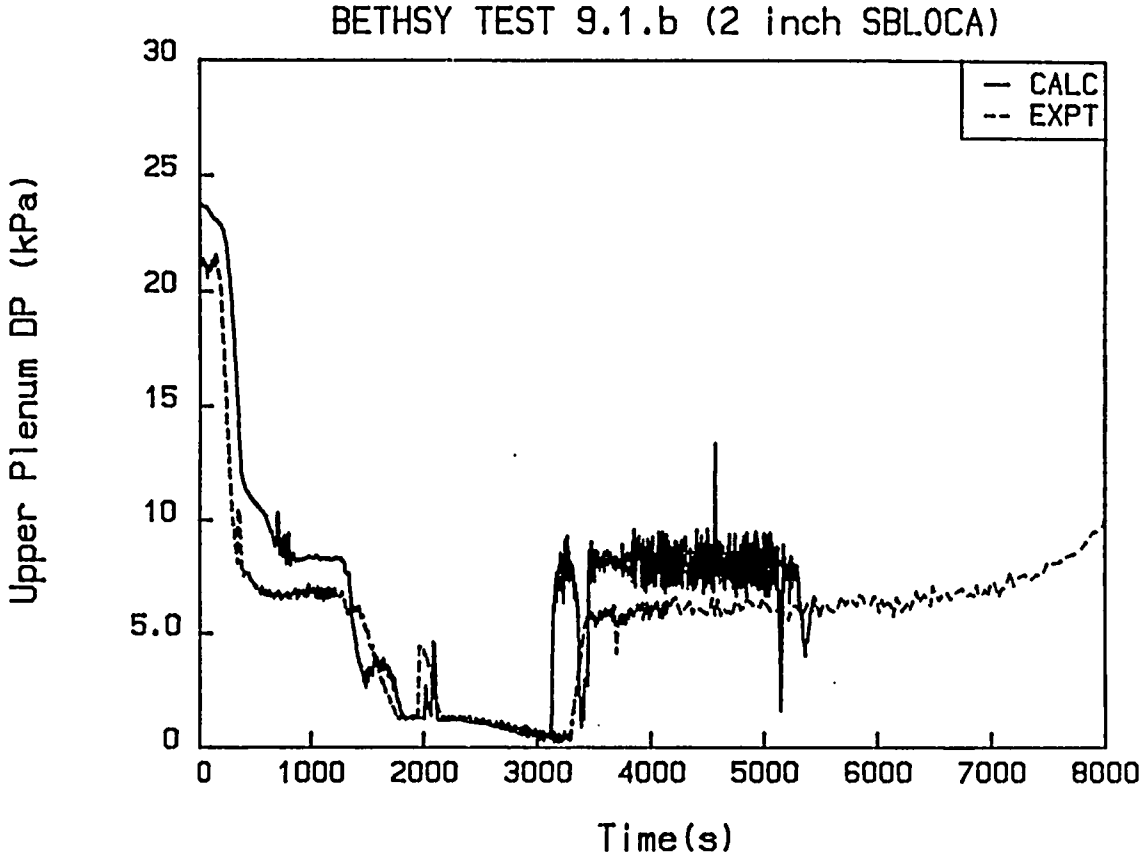

Fig. 6. Upper Plenum Diff. Pressure

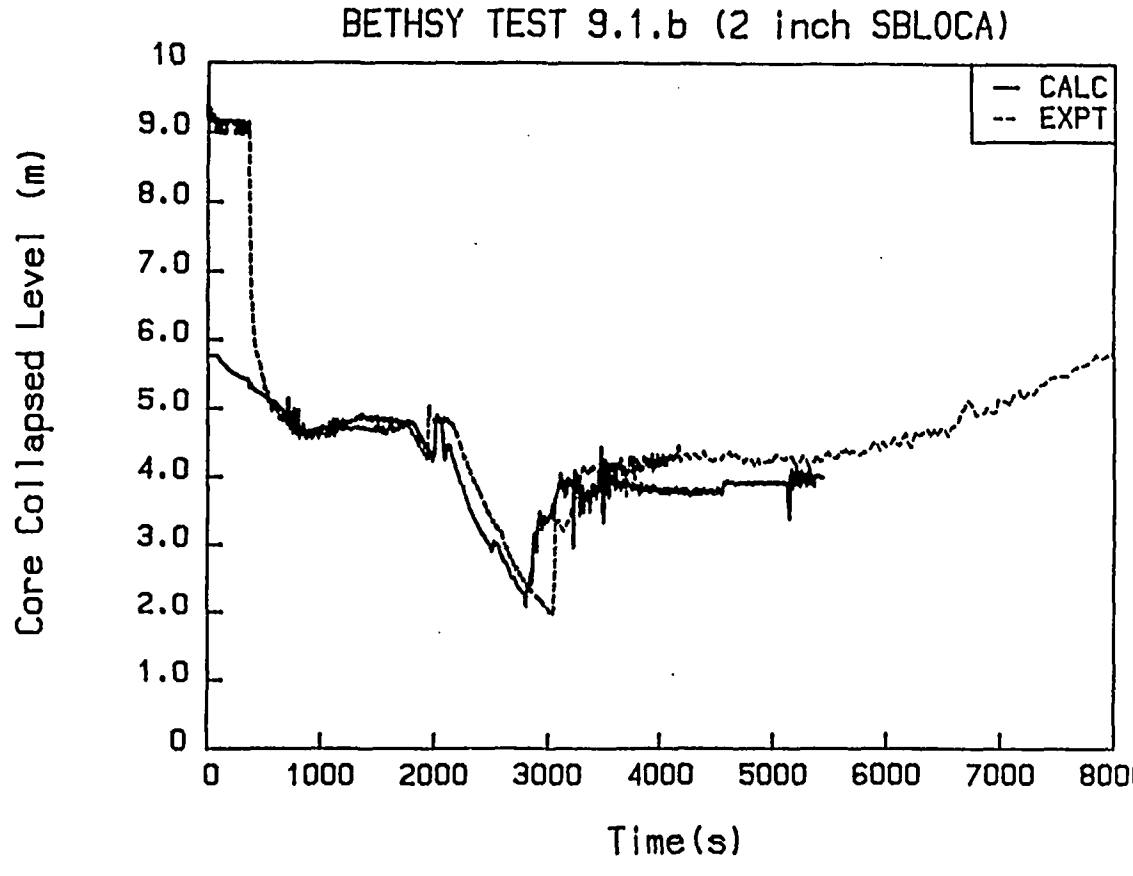

Fig. 7 Core Collapsed Level

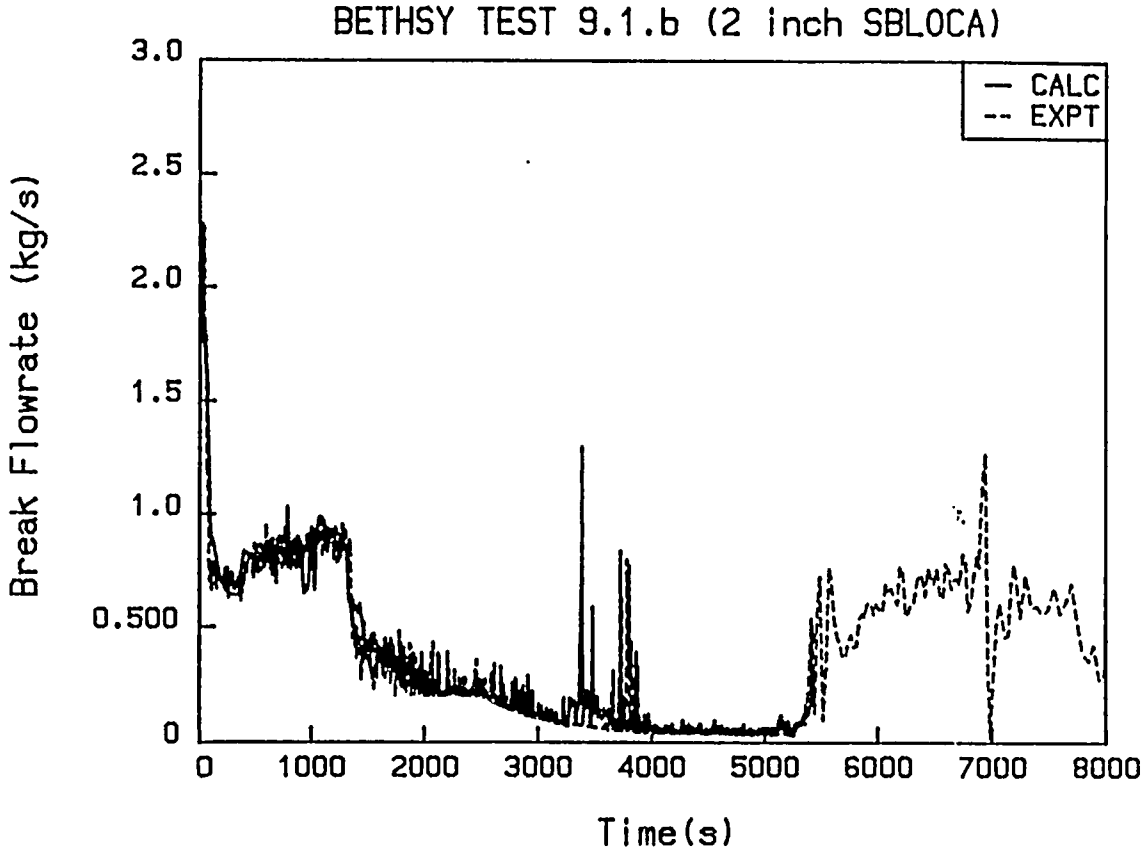

Fig. 8 Break Flowrate

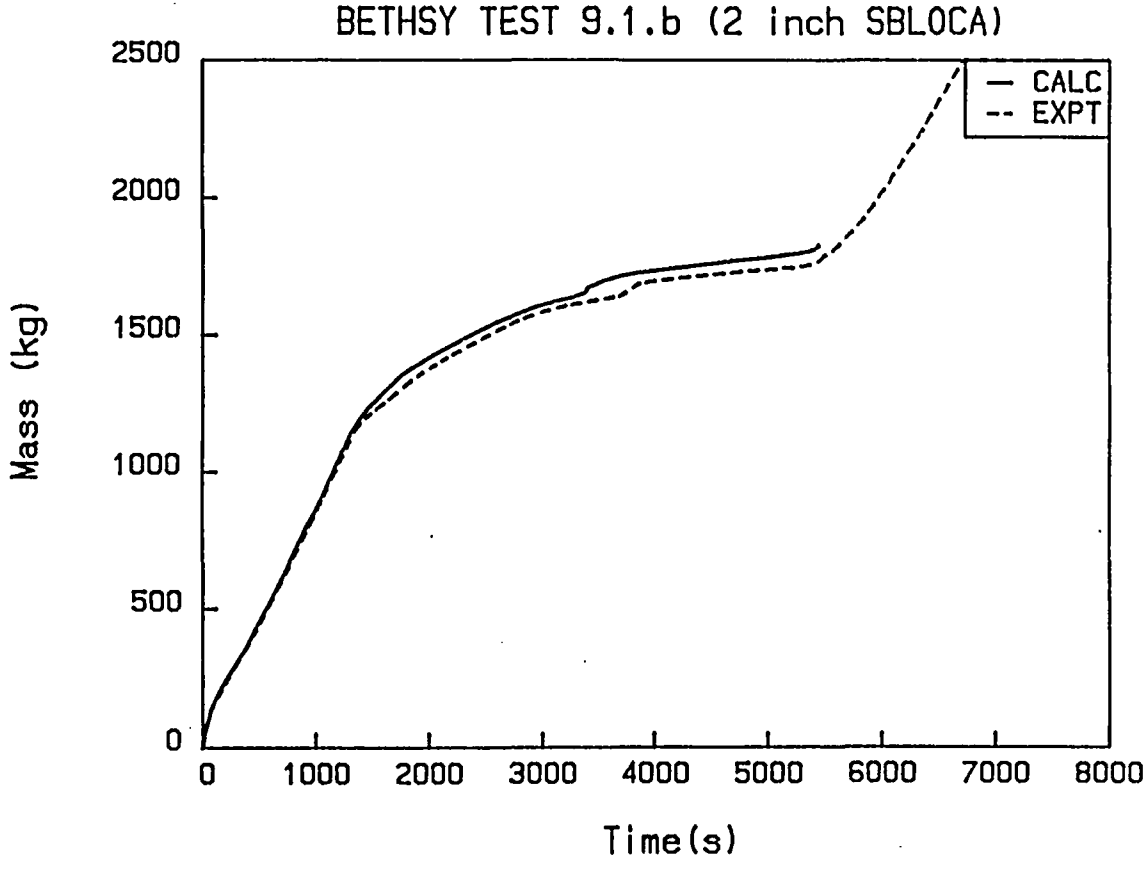

Fig. 9 Integrated Break Mass Flow

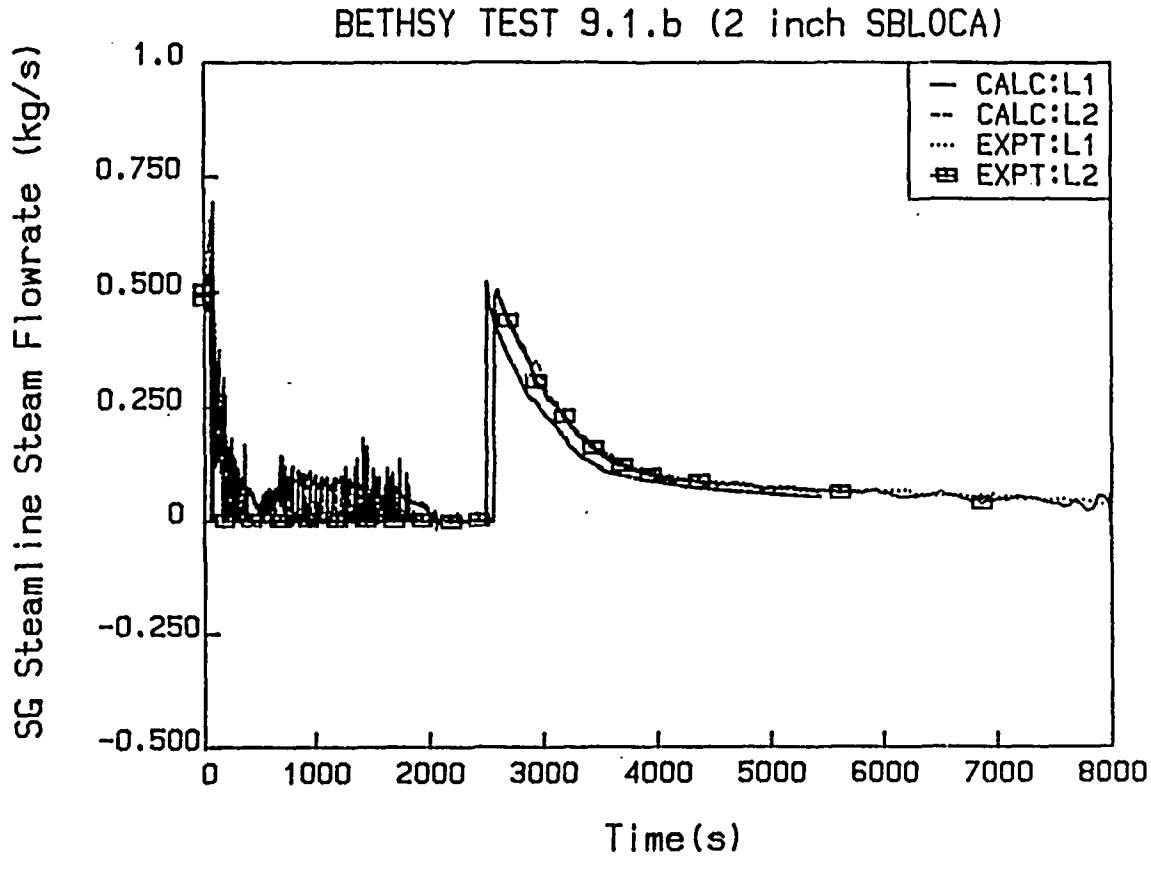

Fig. 10 SG Steamline Steam Flowrate

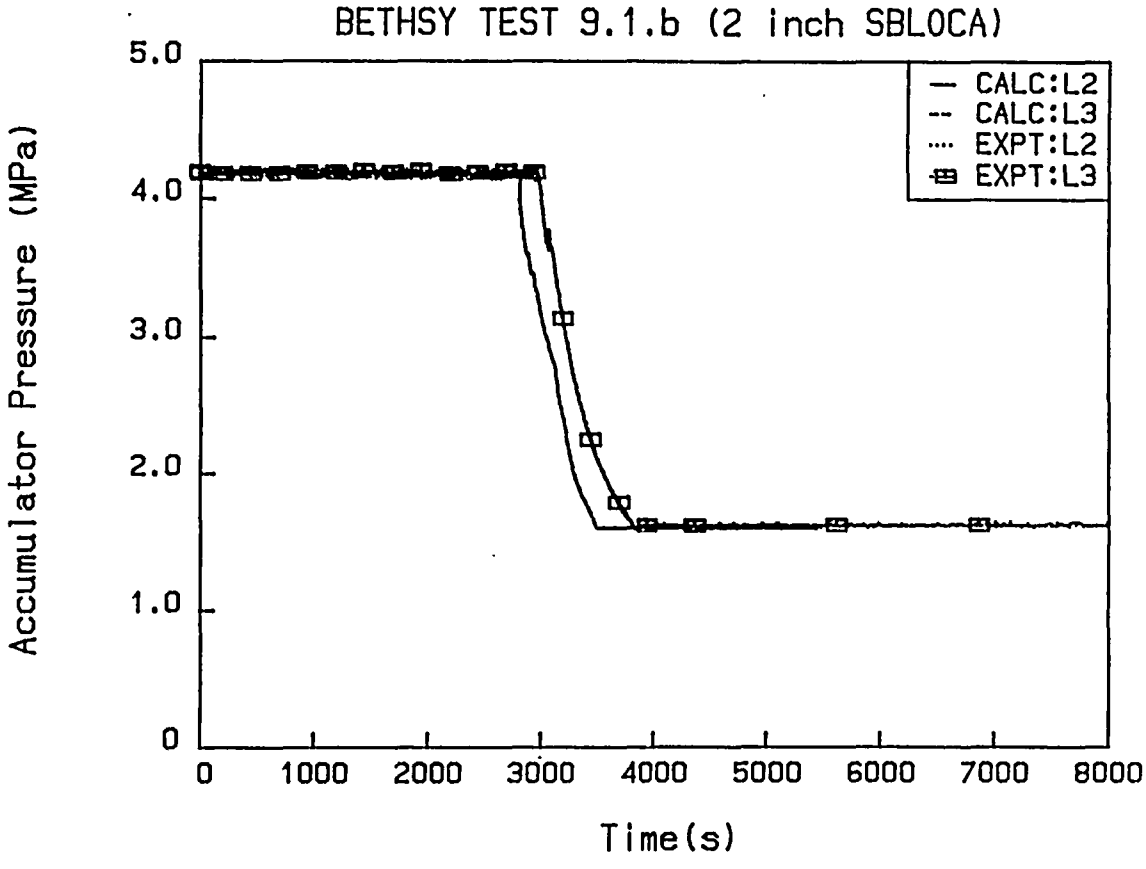

Fig. 11 Accumulator Pressure

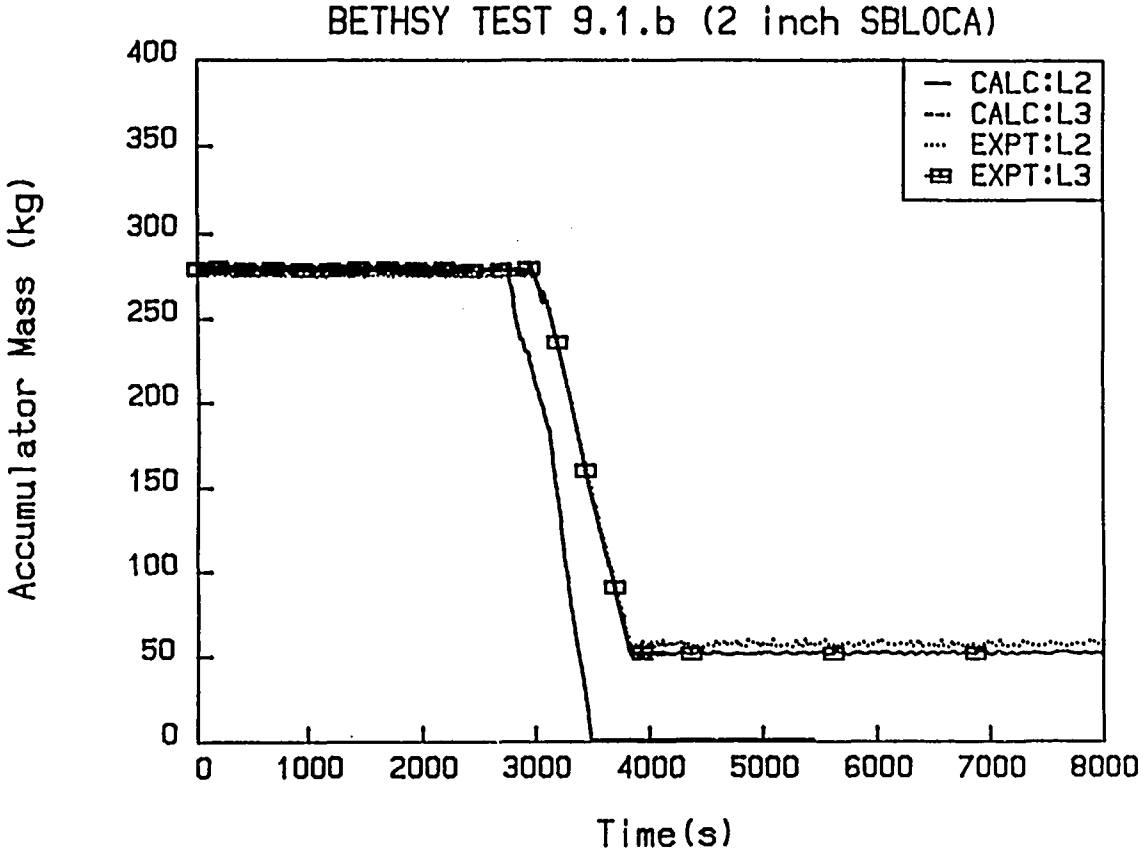

Fig. 12 Accumulator Mass

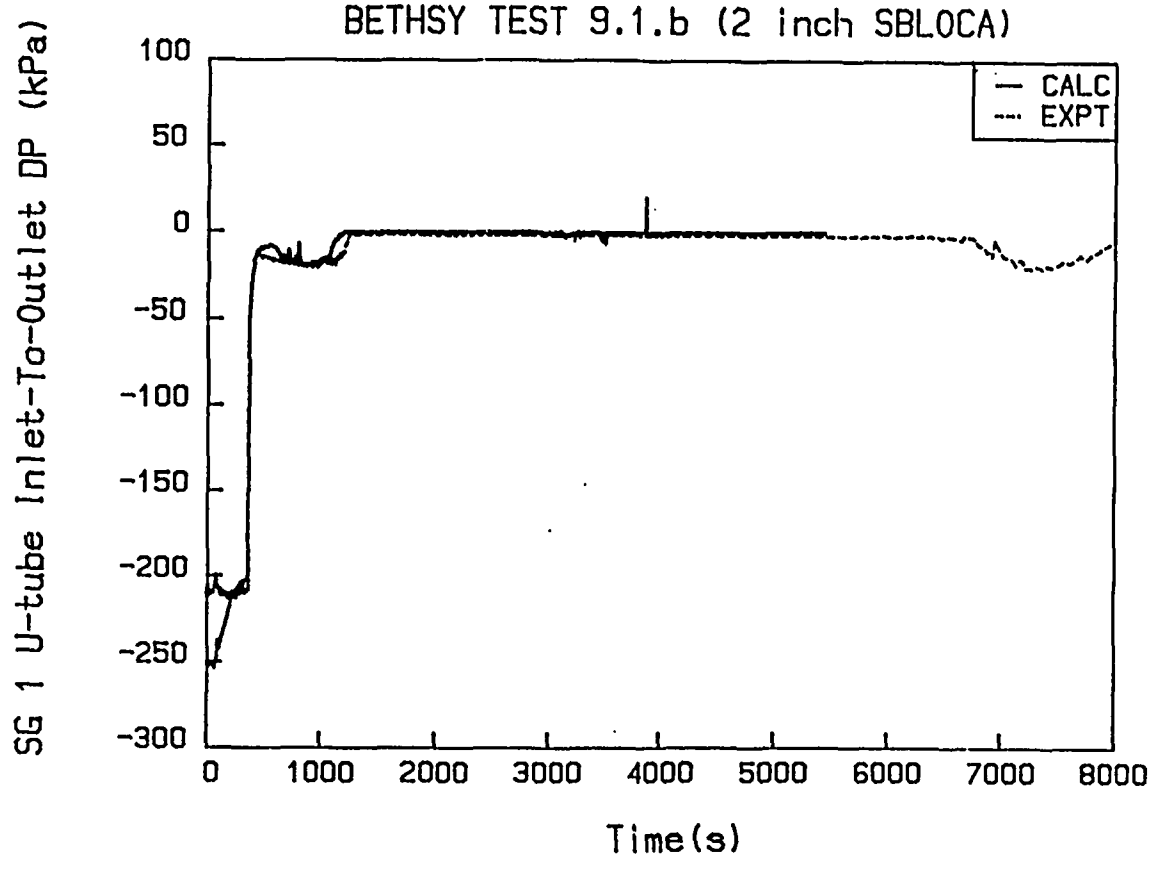

Fig. 13 SG 1 U-tube Inlet-To-Outlet Diff. Pressure

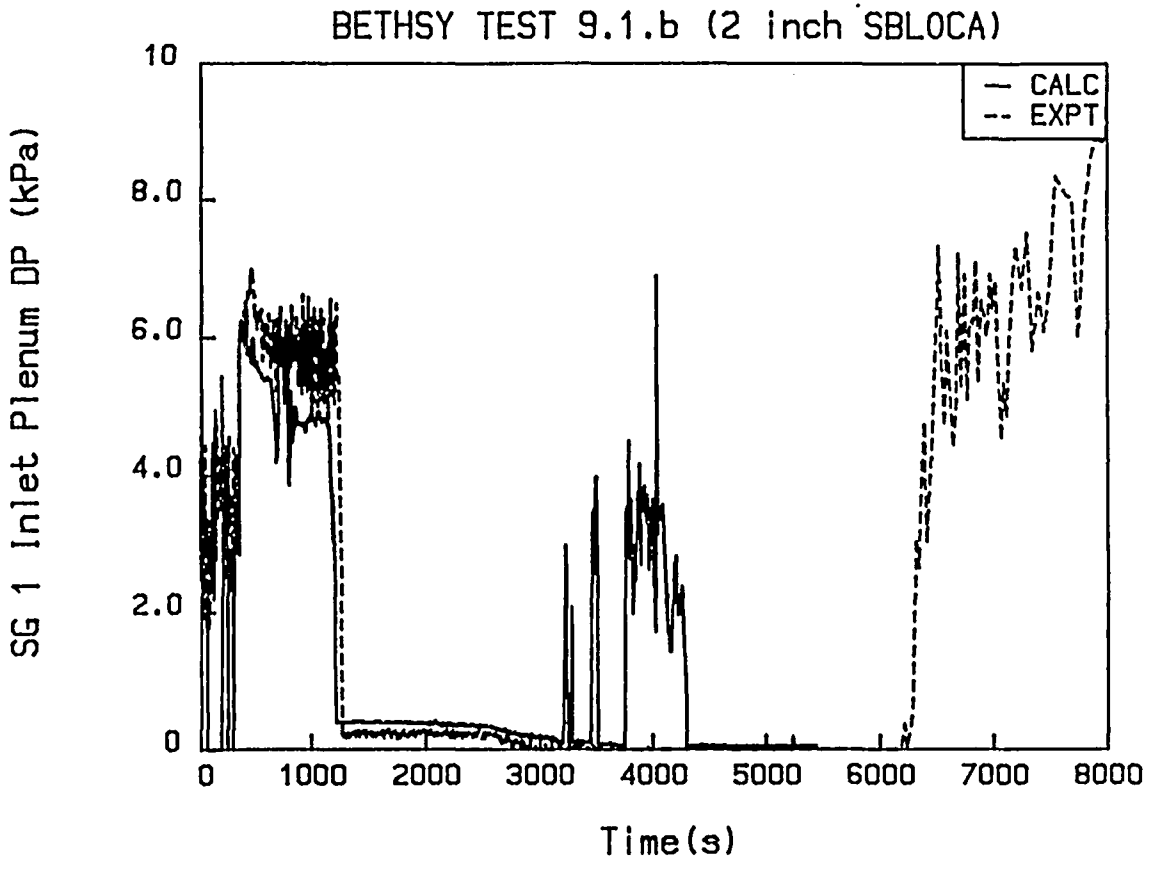

Fig. 14 SG 1 Inlet Plenum Diff. Pressure

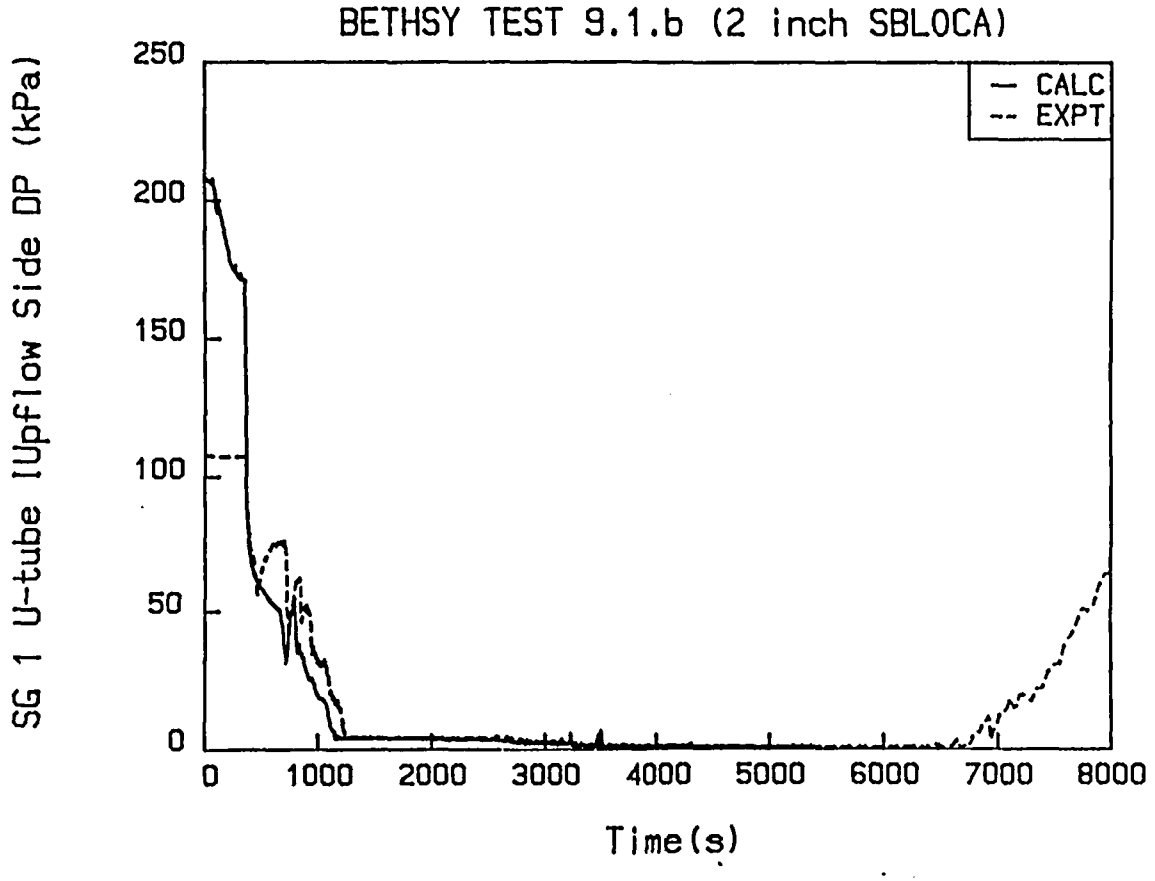

Fig. 15 SG 1 U-tube Upflow Side Diff. Pressure

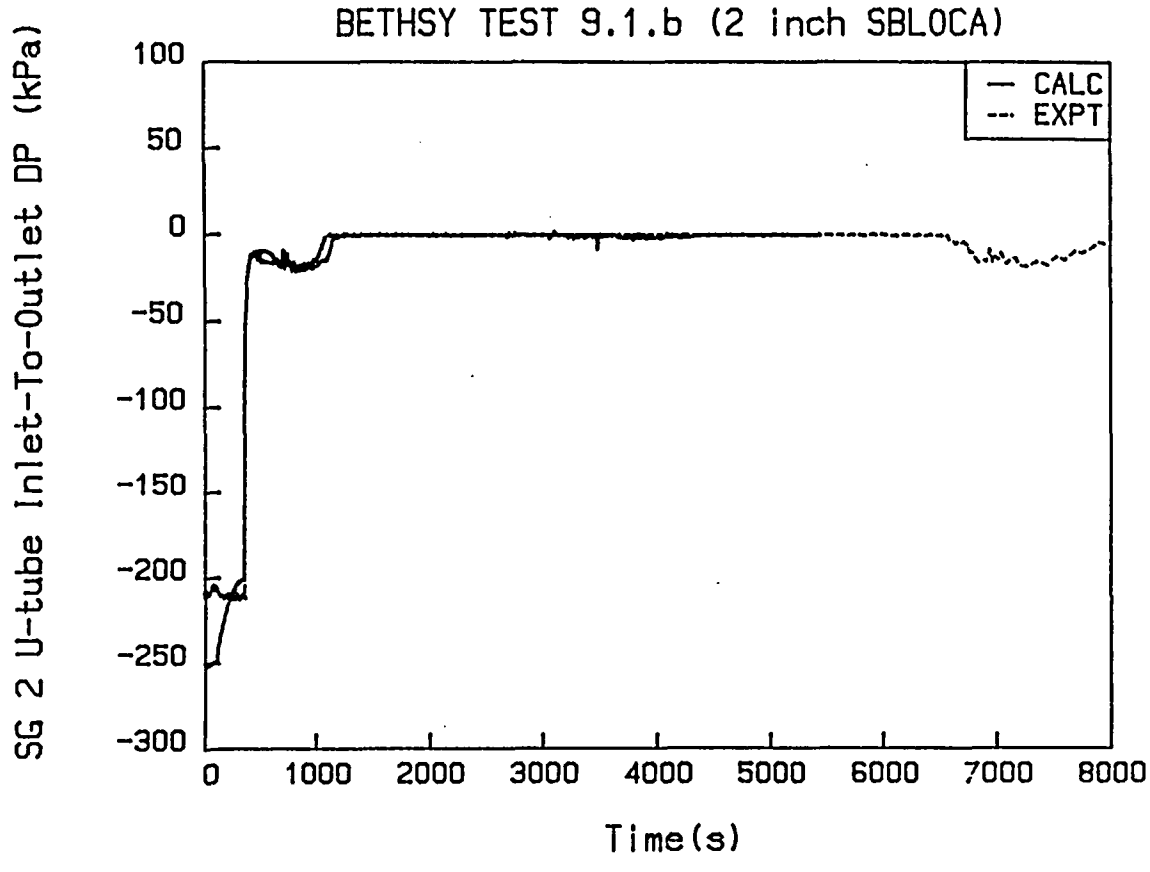

Fig. 16 SG 2 U-tube Inlet-To-Outlet Diff. Pressure

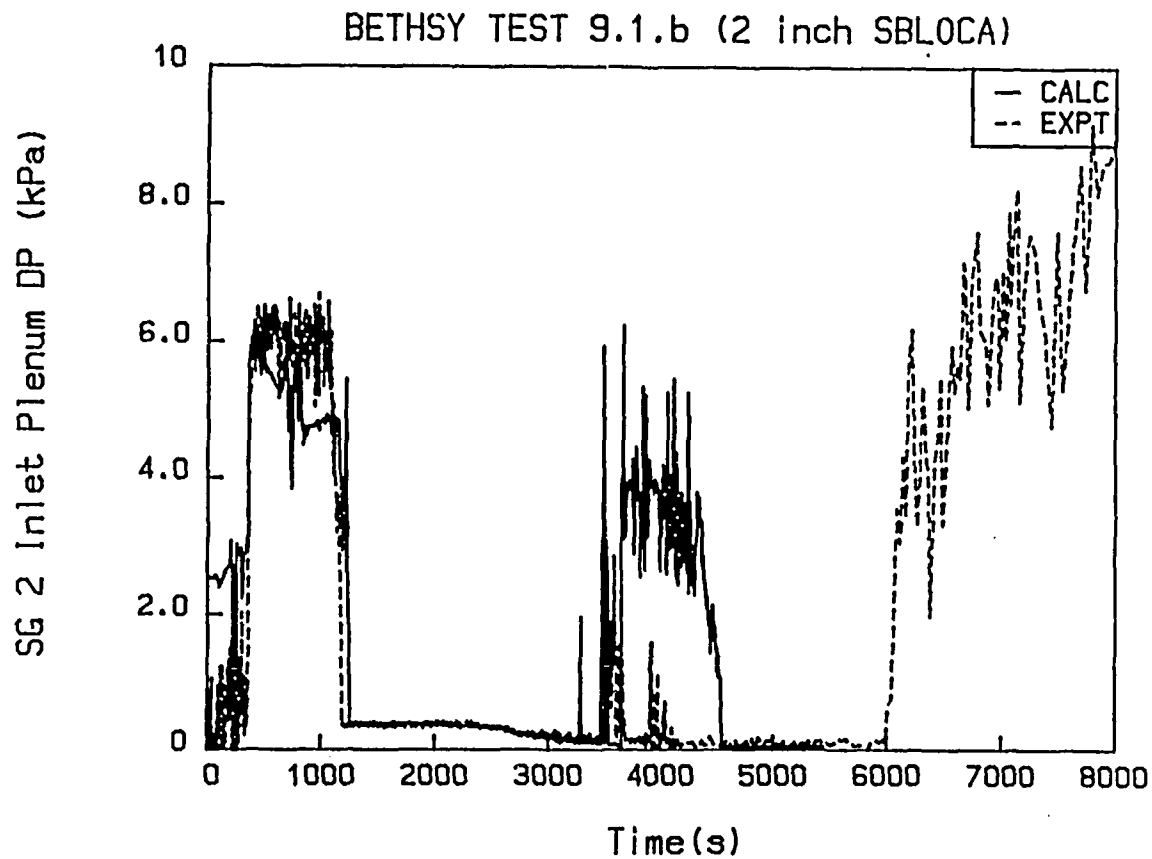

Fig. 17 SG 2 Inlet Plenum Diff. Pressure

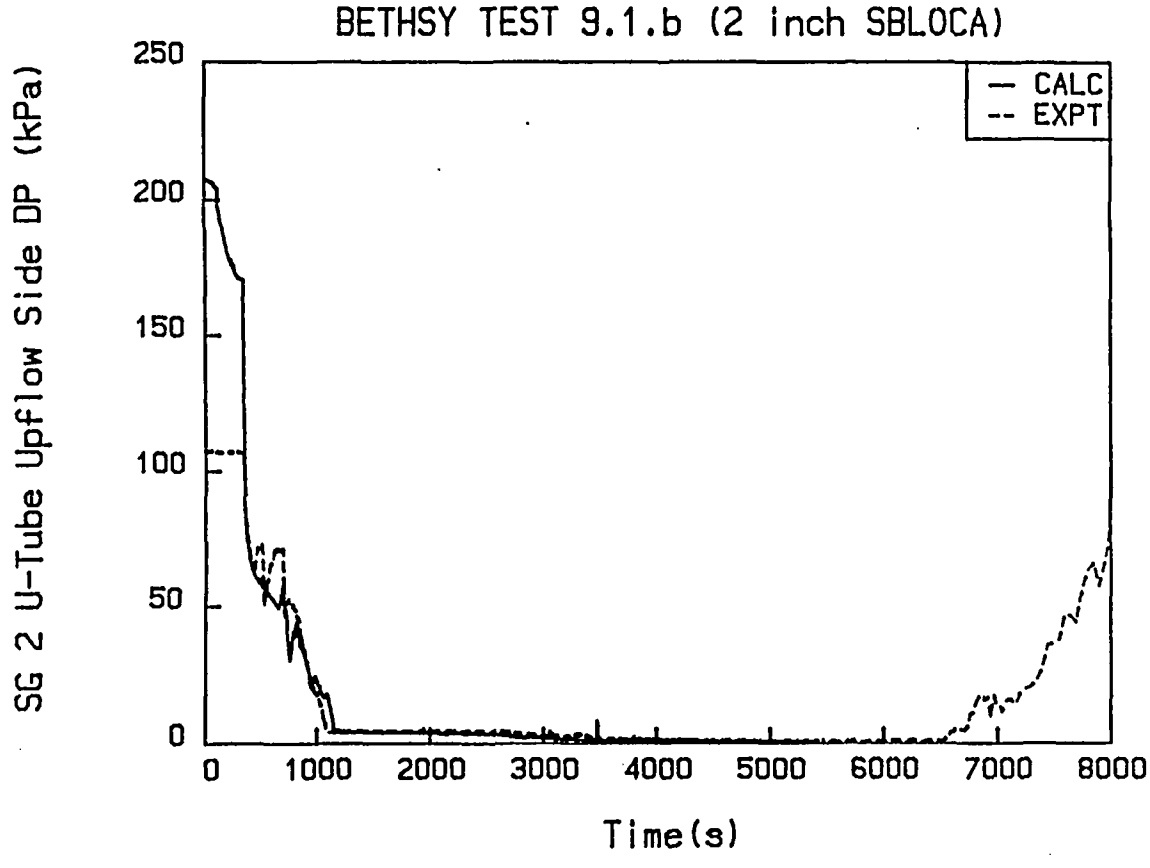

Fig. 18 SG 2 U-tube Upflow Side Diff. Pressure

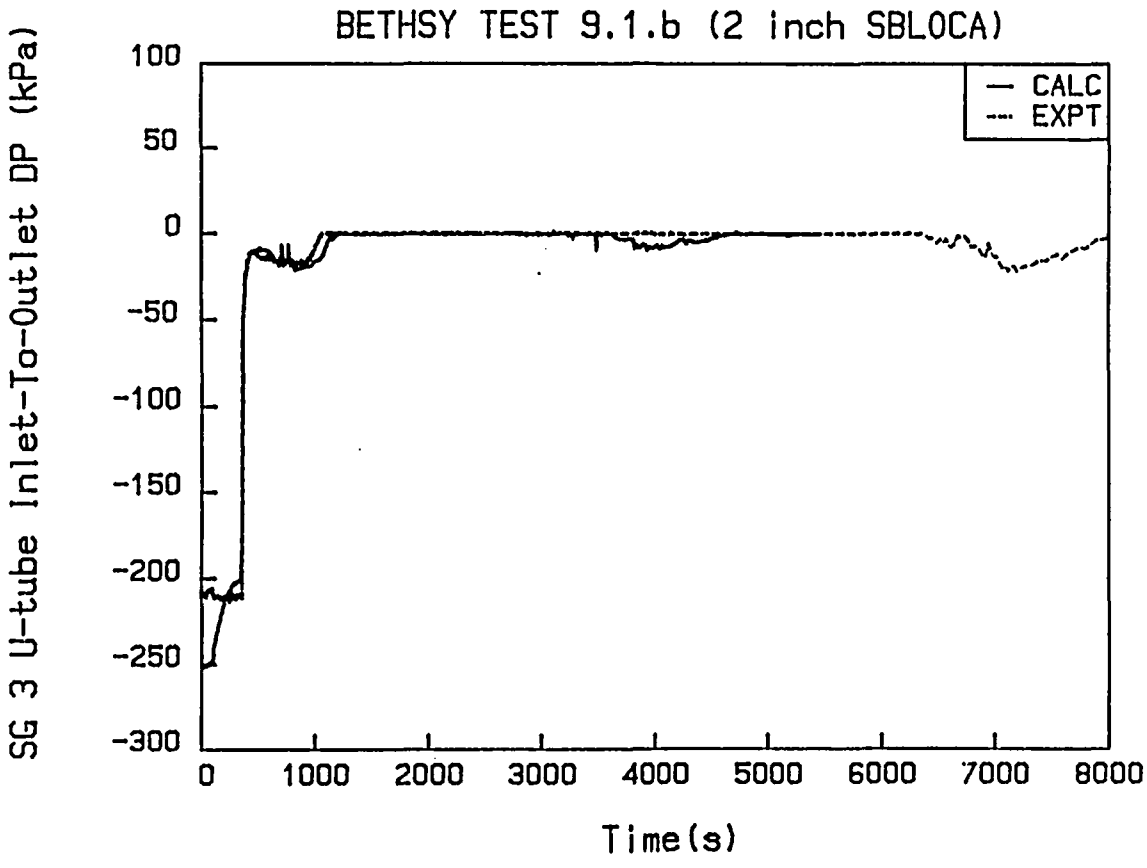

Fig. 19 SG 3 U-tube Inlet-To-Outlet Diff. Pressure

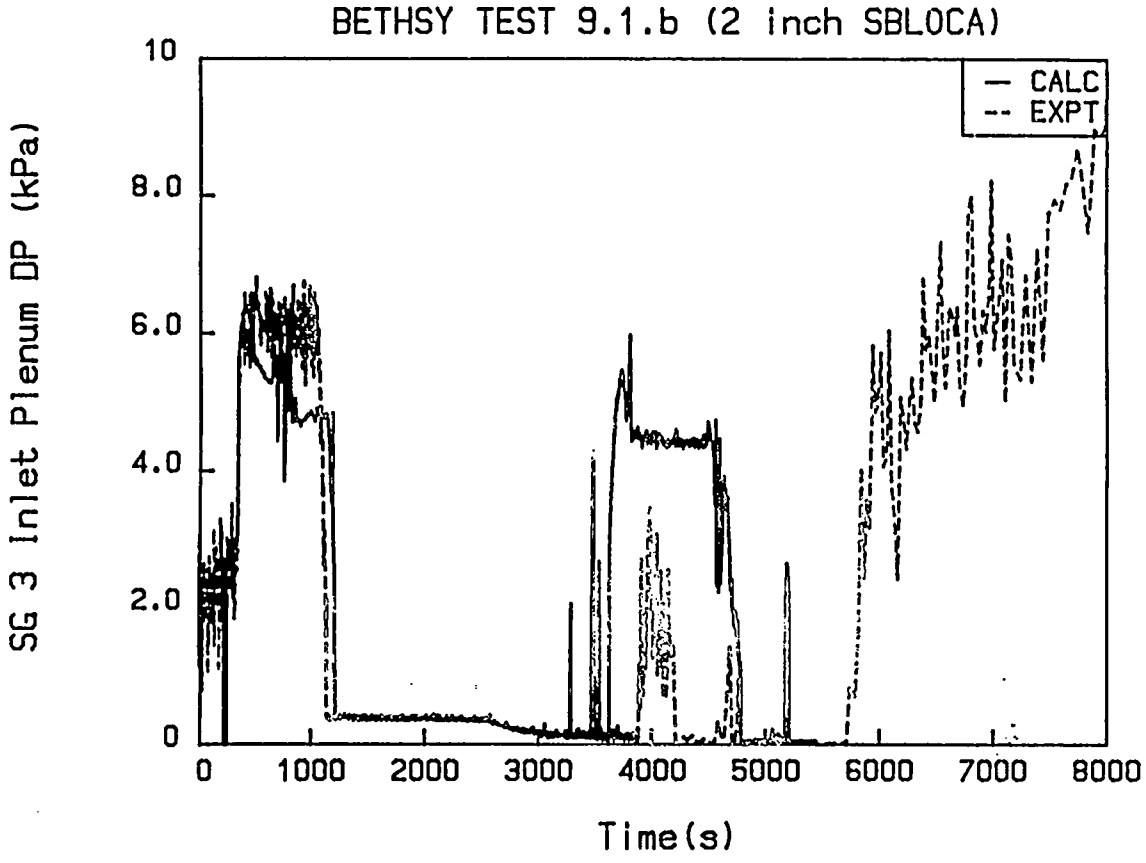

Fig. 20 SG 3 Inlet Plenum Diff. Pressure

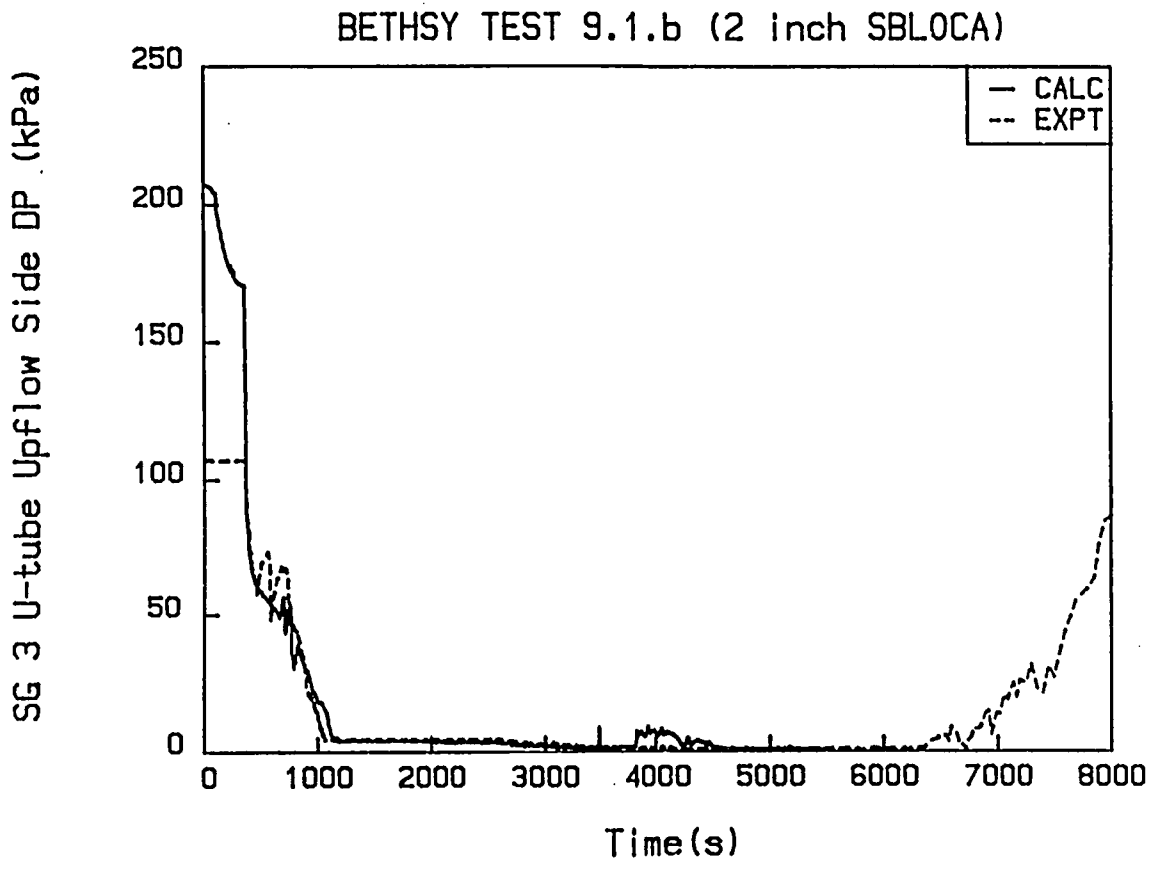

Fig. 21 SG 3 U-tube Upflow Side Diff. Pressure

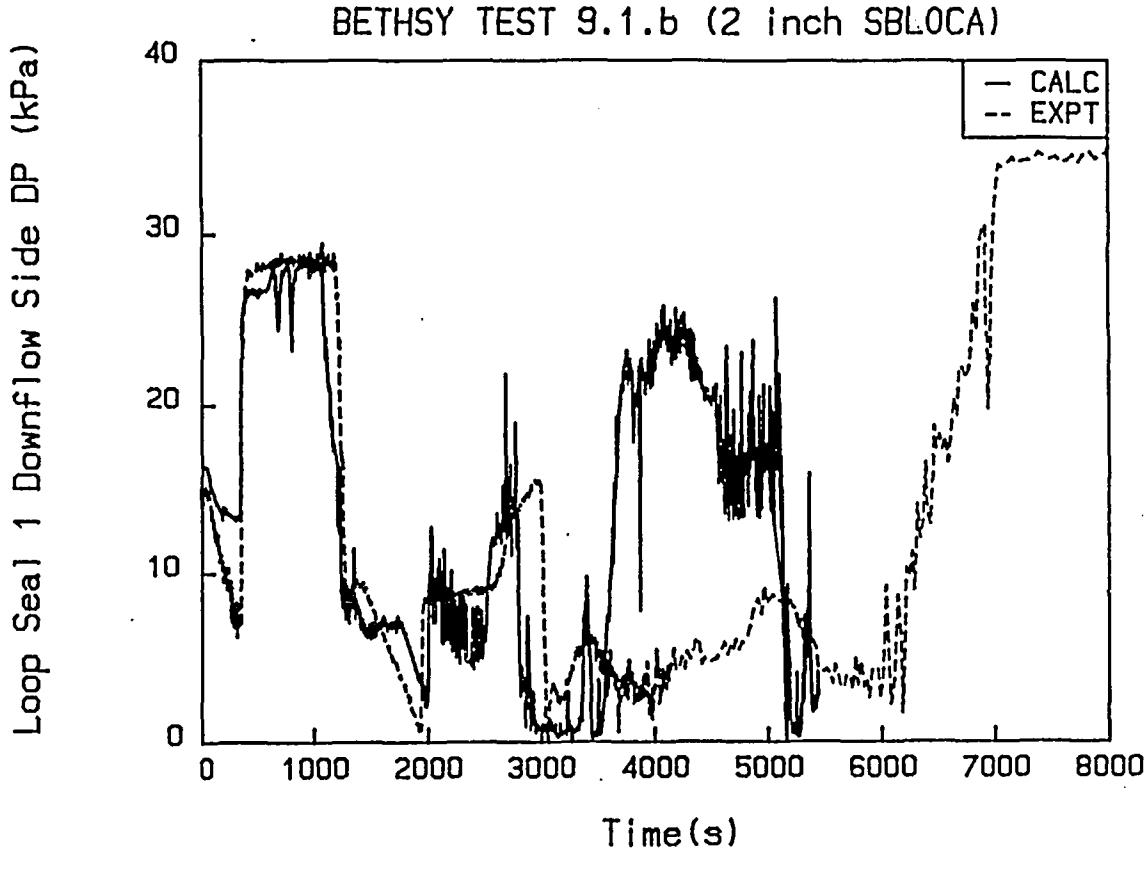

Fig. 22 Loop Seal 1 Downflow Side Diff. Pressure

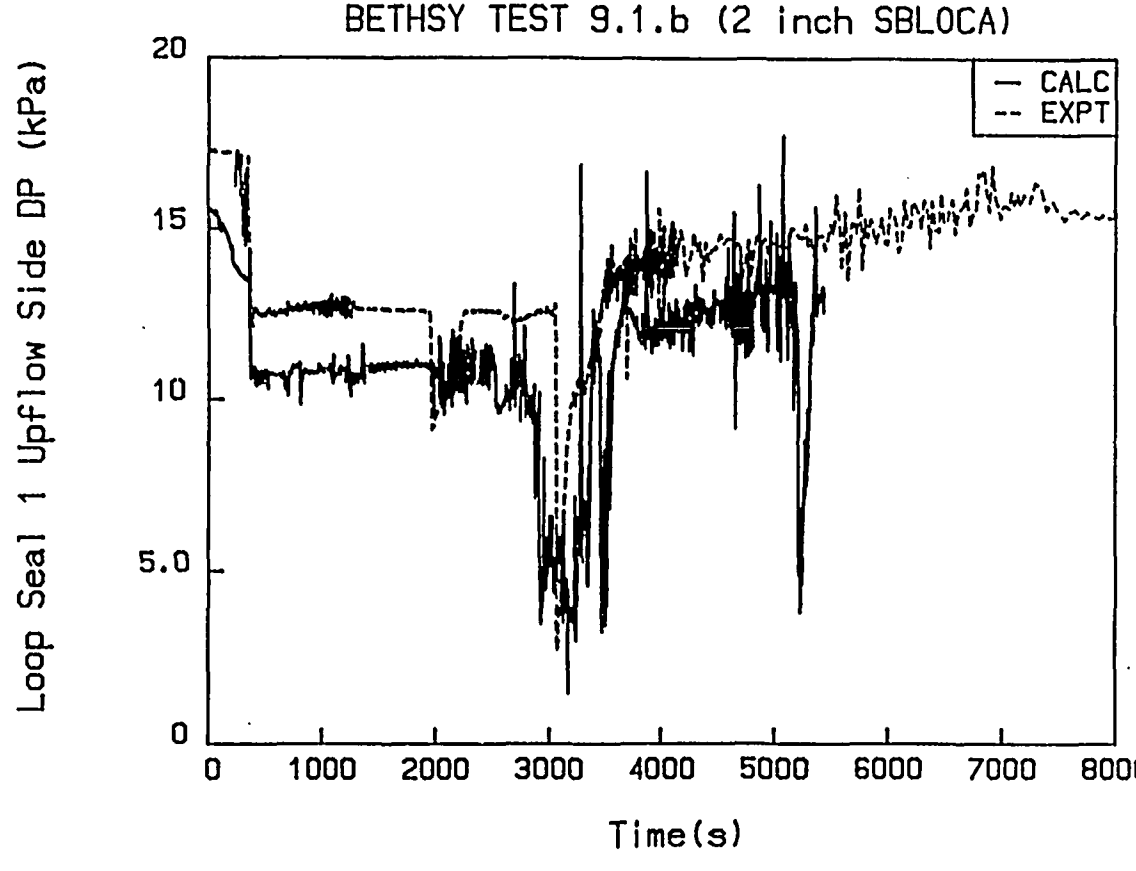

Fig. 23 Loop Seal 1 Upflow Side Diff. Pressure

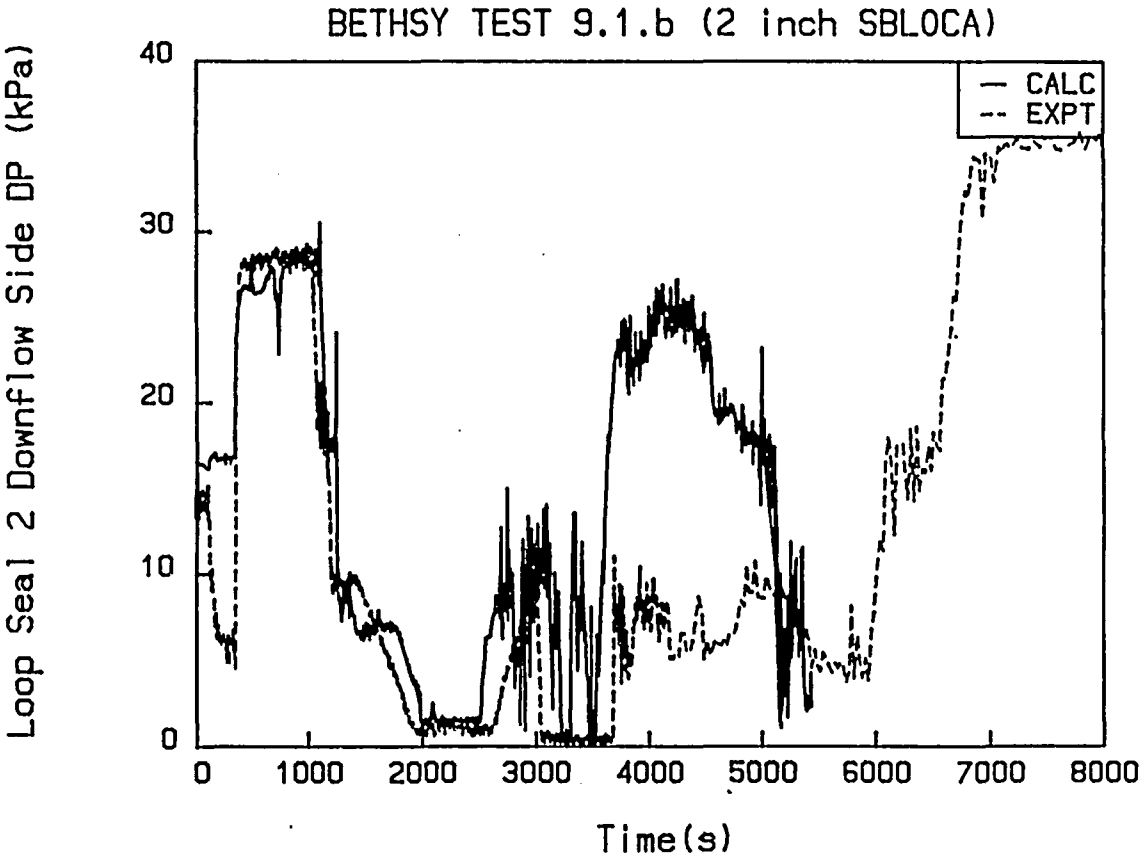

Fig. 24 Loop Seal 2 Downflow Side Diff. Pressure

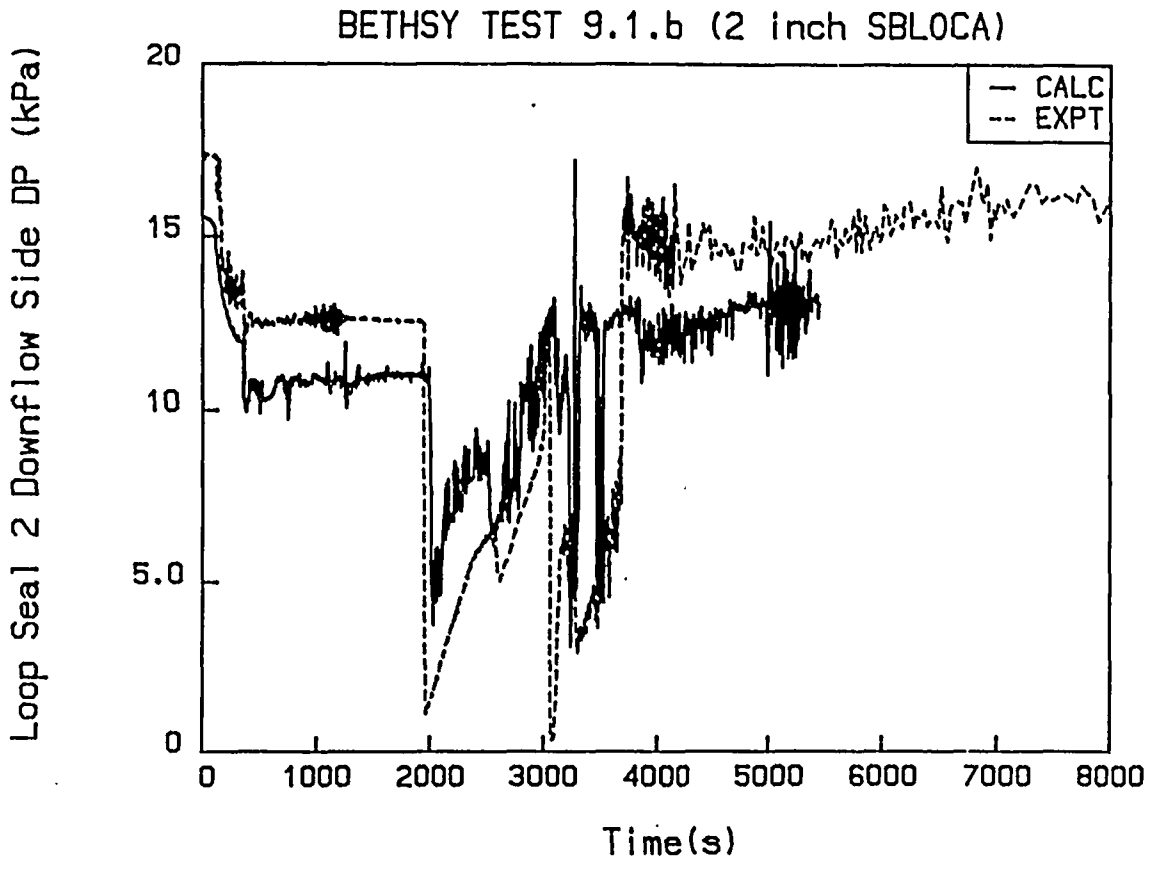

Fig. 25 Loop Seal 2 Upflow Side Diff. Pressure

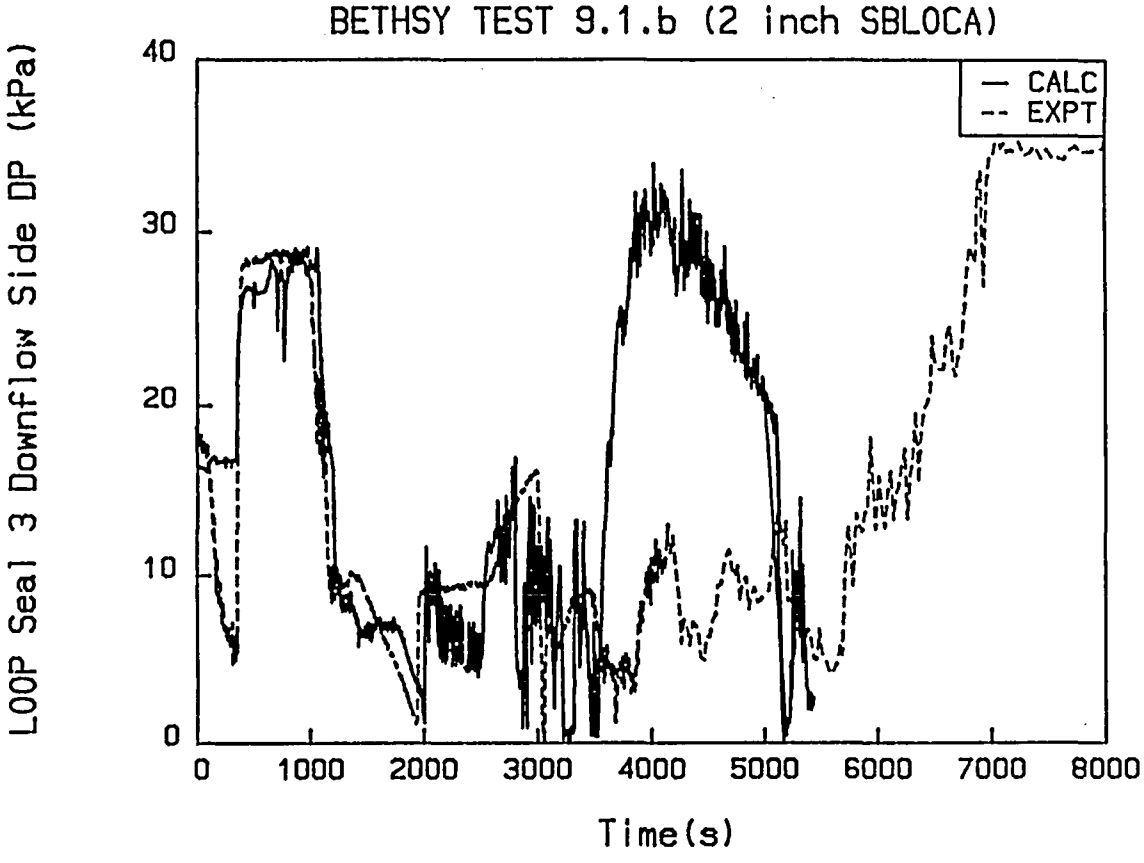

Fig. 26 Loop Seal 3 Downflow Side Diff. Pressure

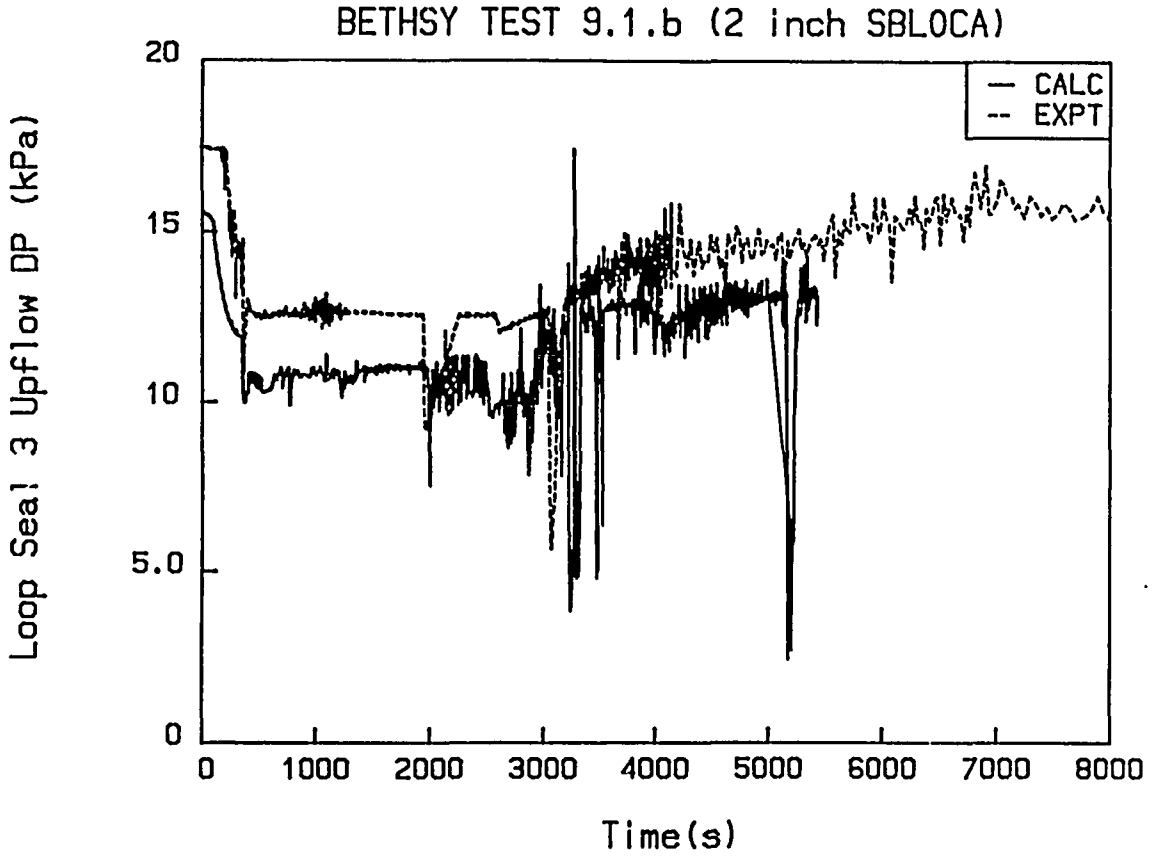

Fig. 27 Loop Seal 3 Upflow Side Diff. Pressure

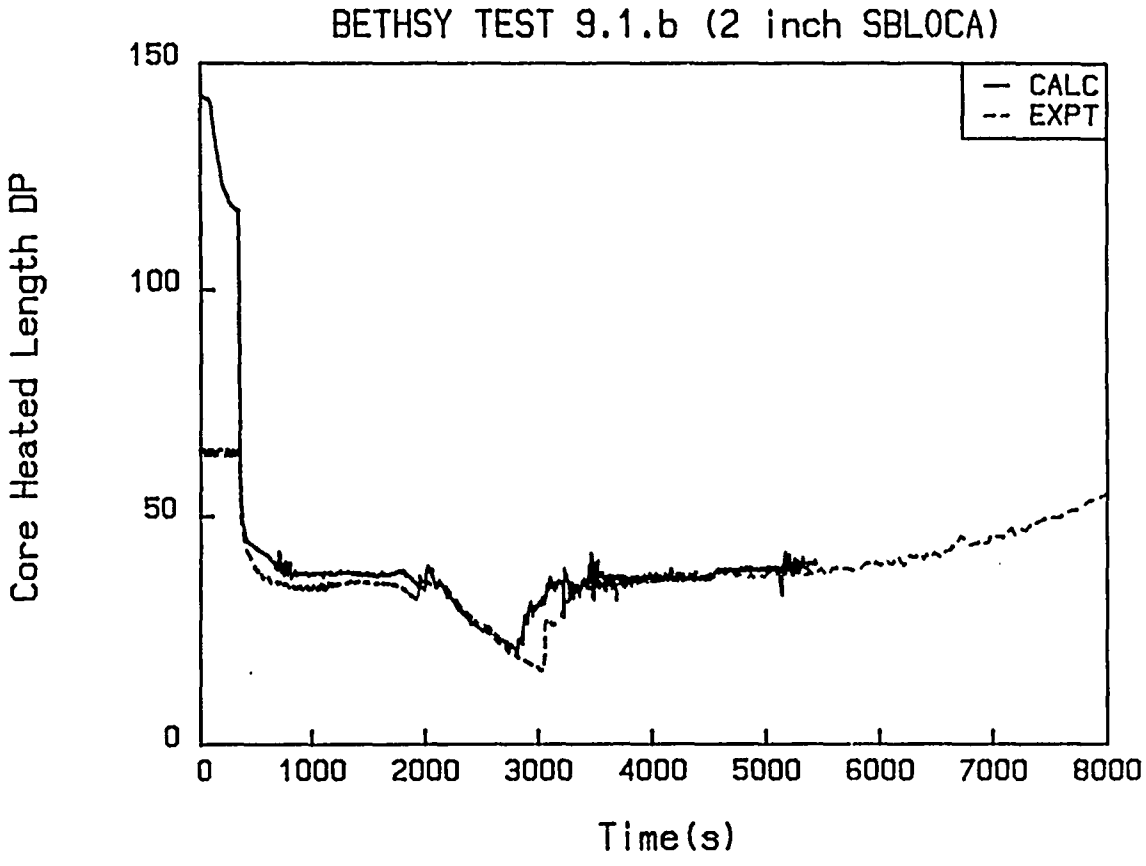

Fig. 28 Core Heated Length Diff. Pressure

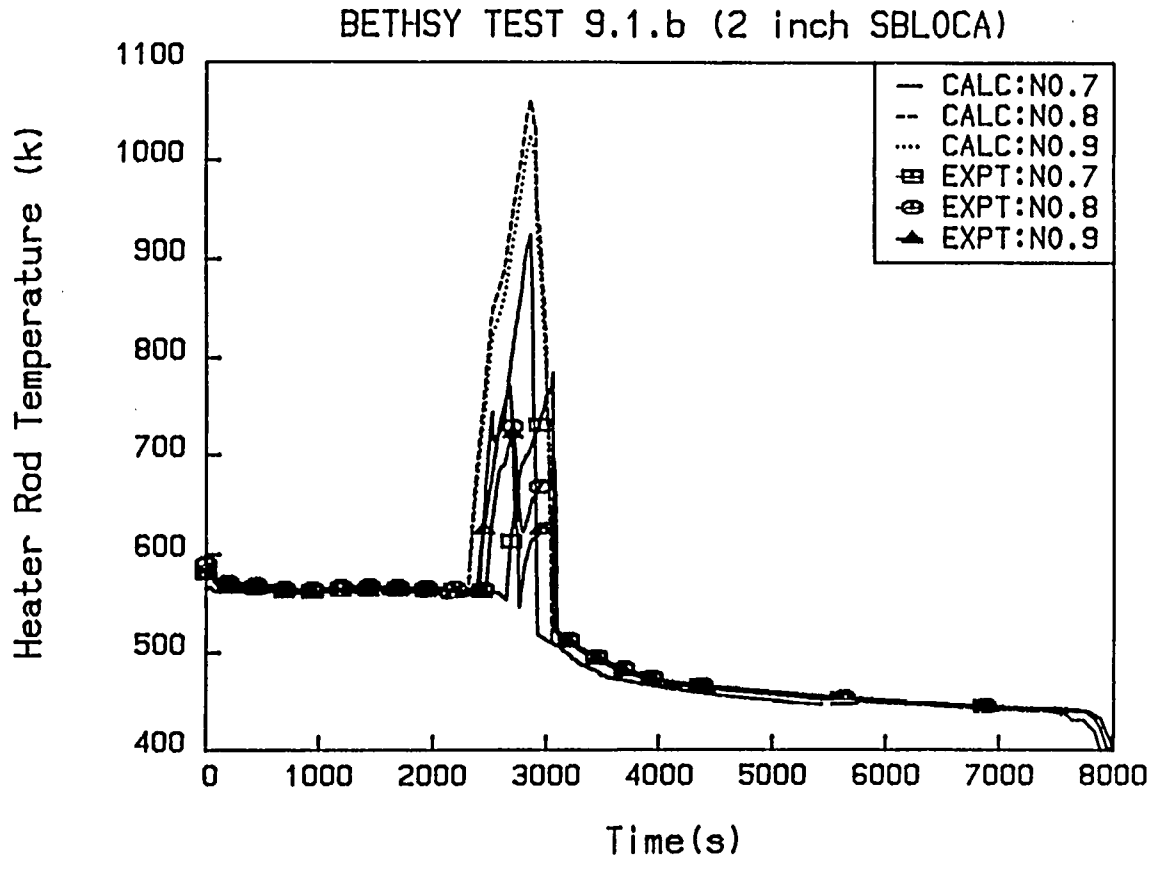

Fig. 29 Heater Rod Temperatures

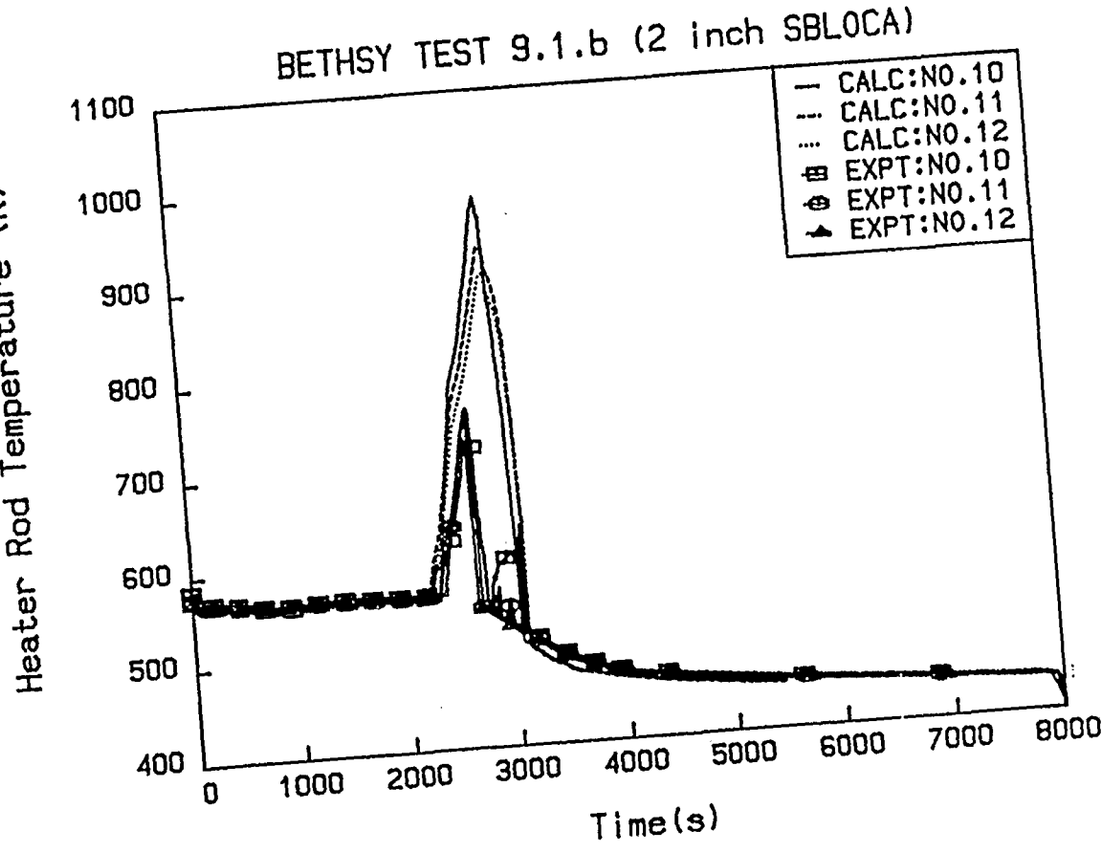

Fig. 30 Heater Rod Temperatures

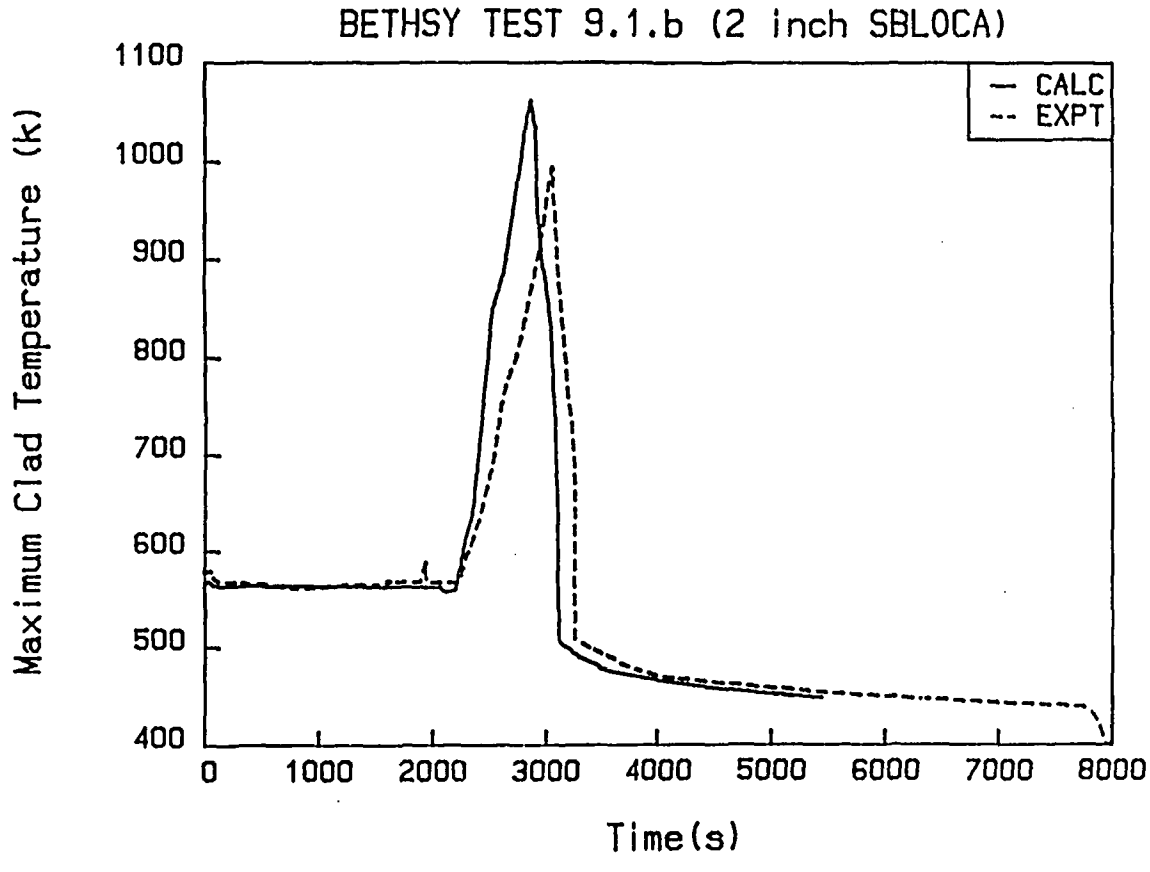

Fig. 31 Maximum Clad Temperaturte

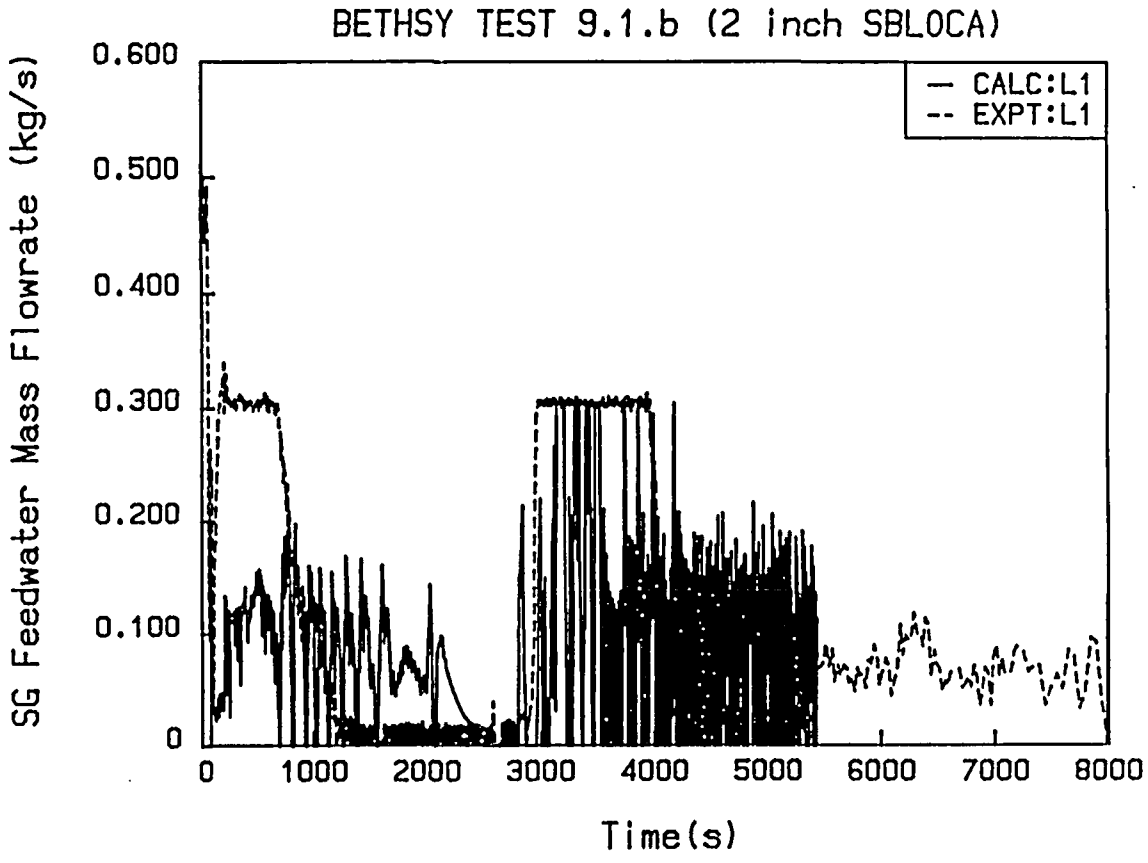

Fig. 32 SG Feedwater Mass Flowrate

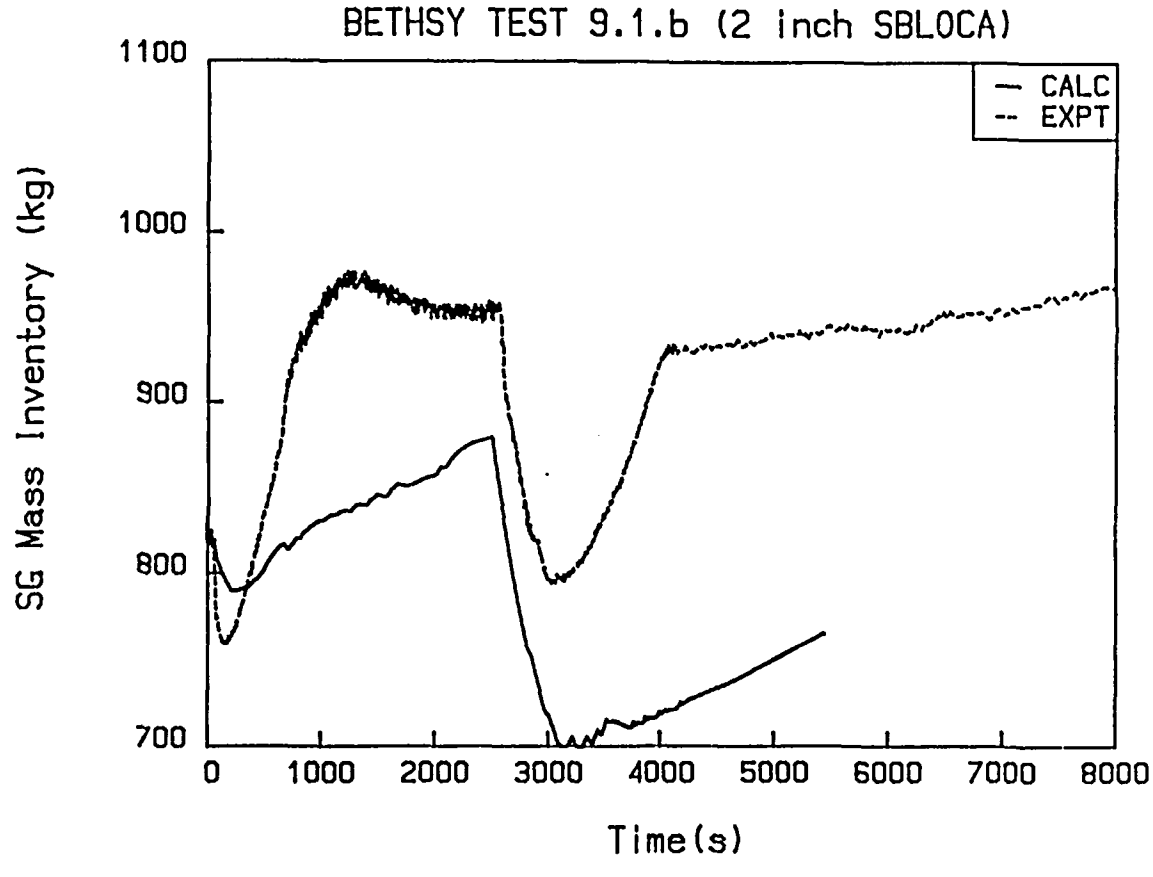

Fig. 33 SG Mass Inventory

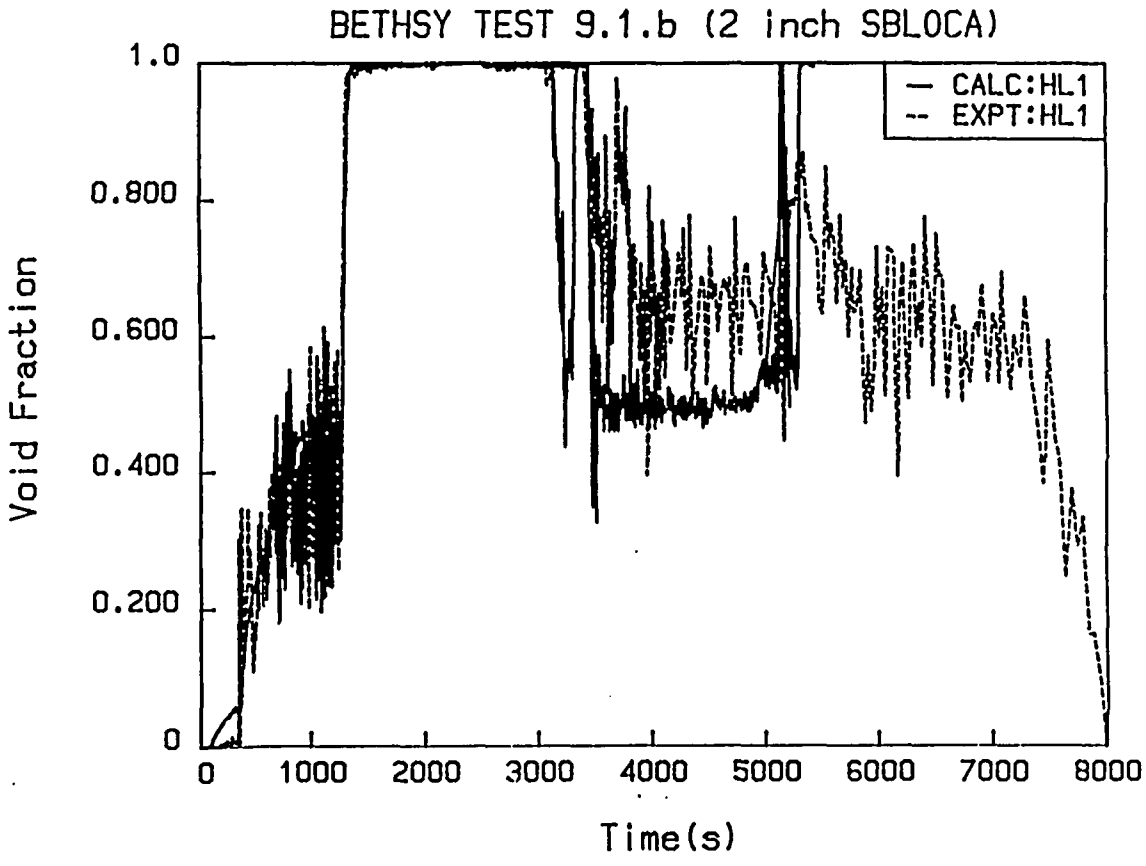

Fig. 34 Hot Leg 1 Void Fractions

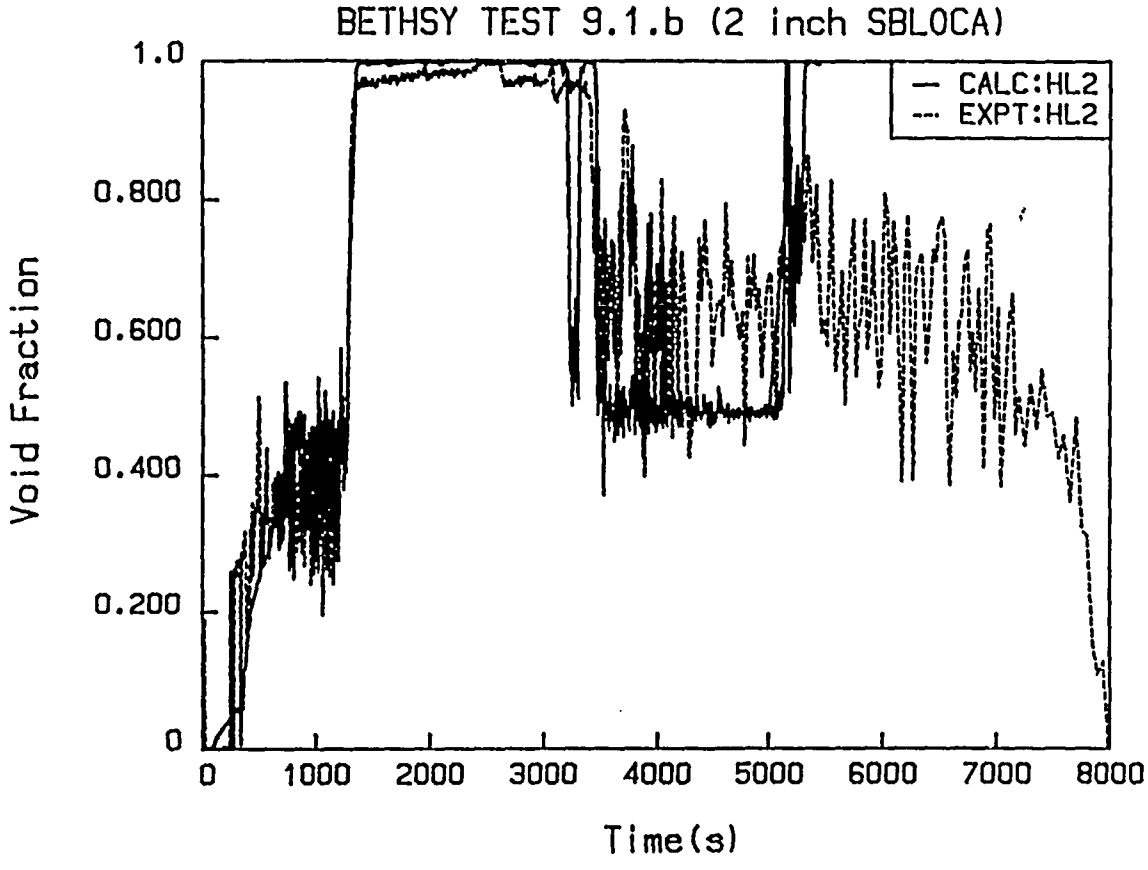

Fig. 35 Hot Leg 2 Void Fractions

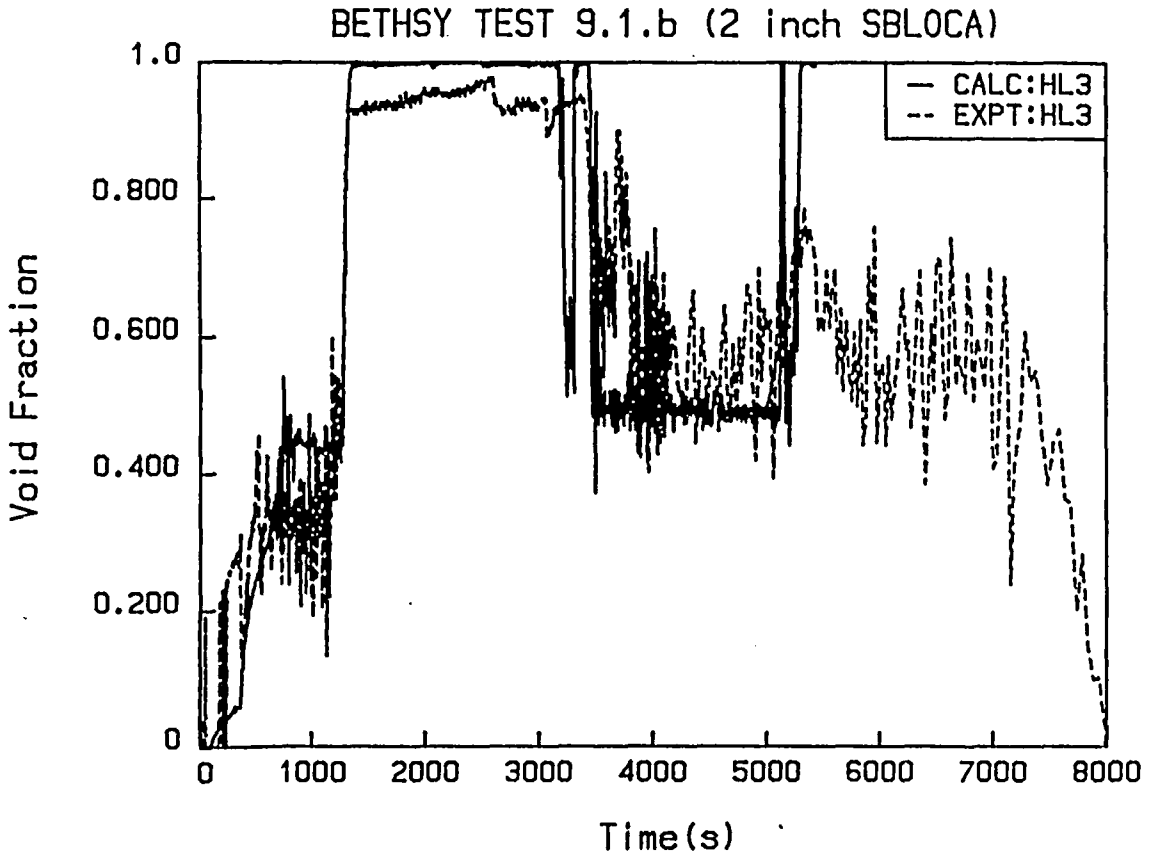

Fig. 36 Hot Leg 3 Void Fractions

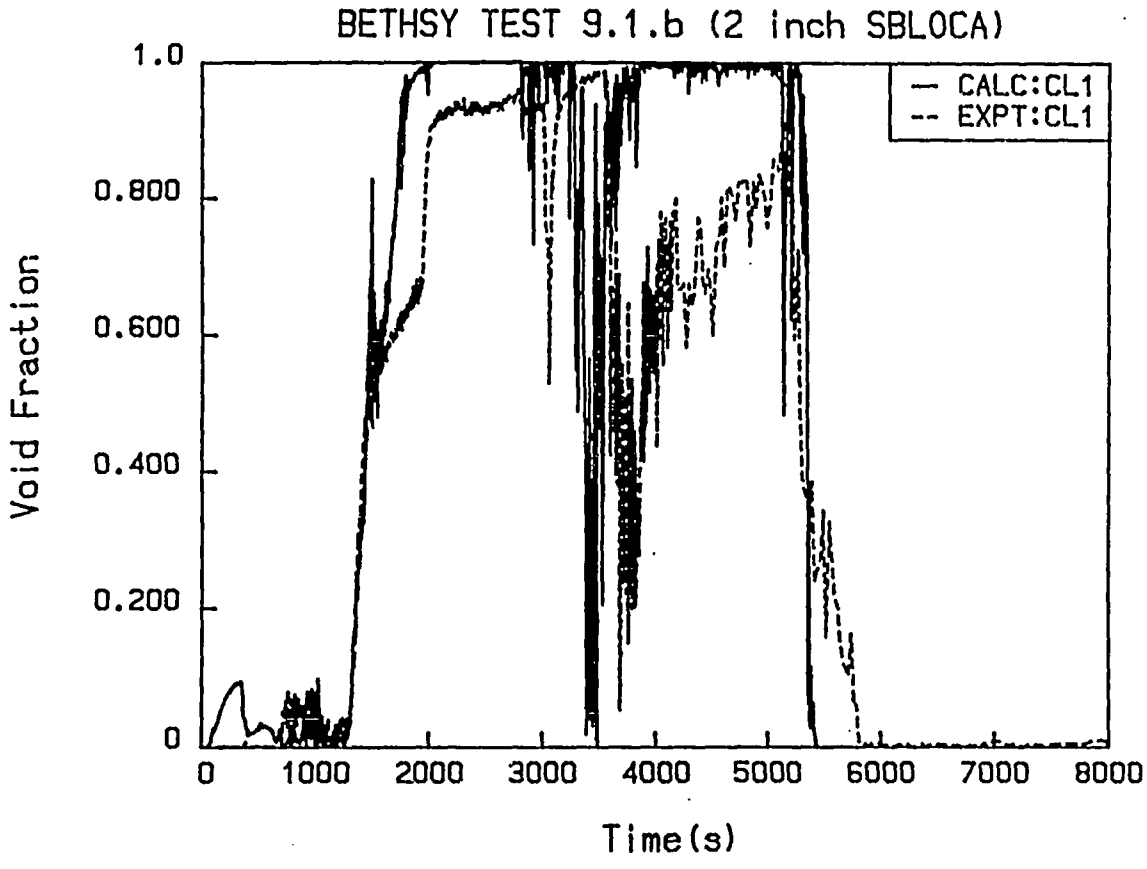

Fig.37 Cold Leg 1 Void Fractions

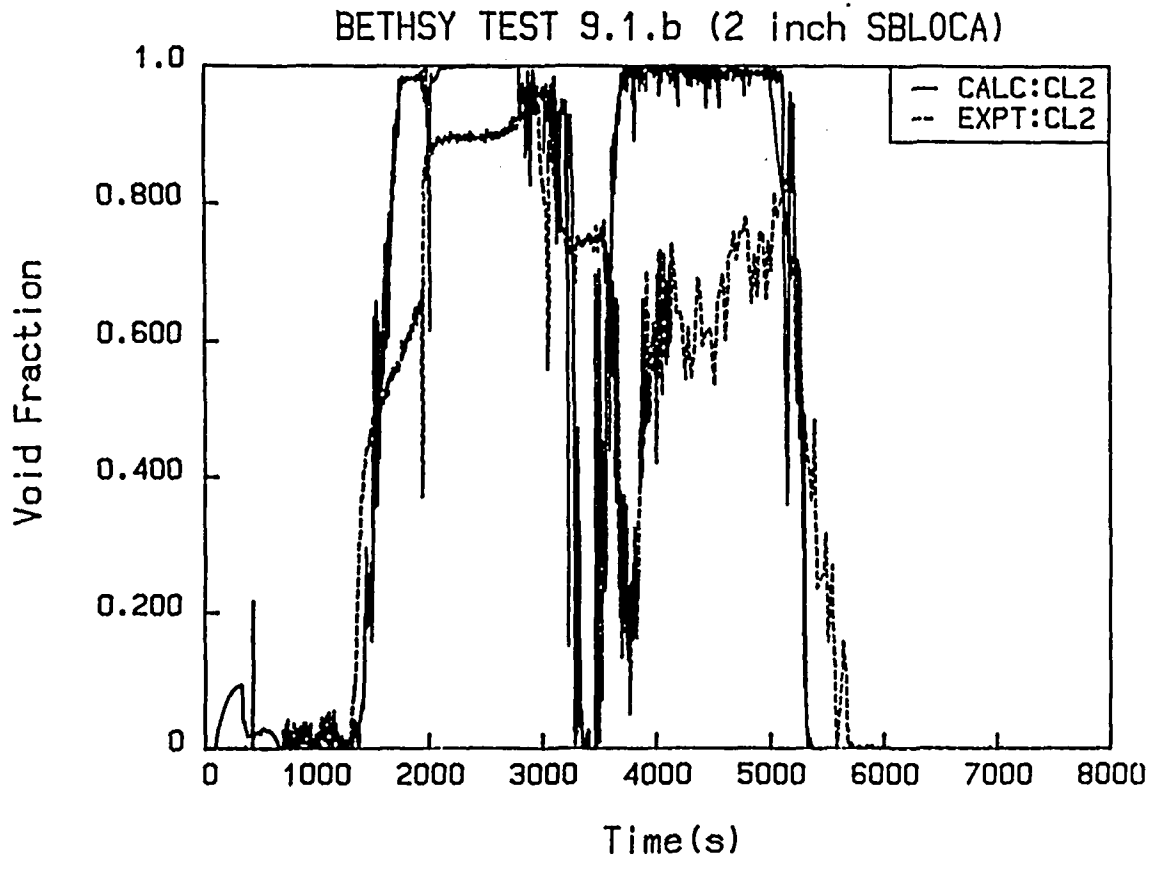

Fig. 38 Cold Leg 2 Void Fractions

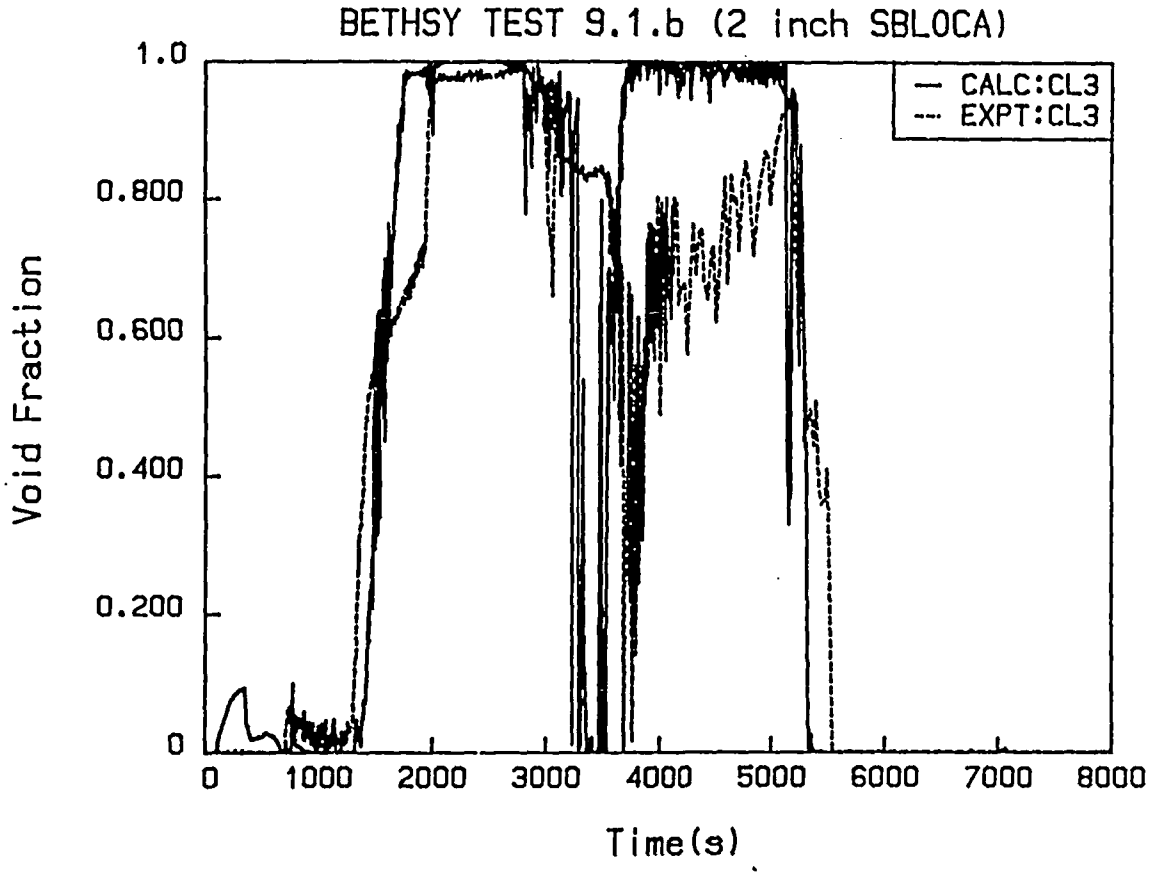

Fig. 39 Cold Leg 3 Void Fractions

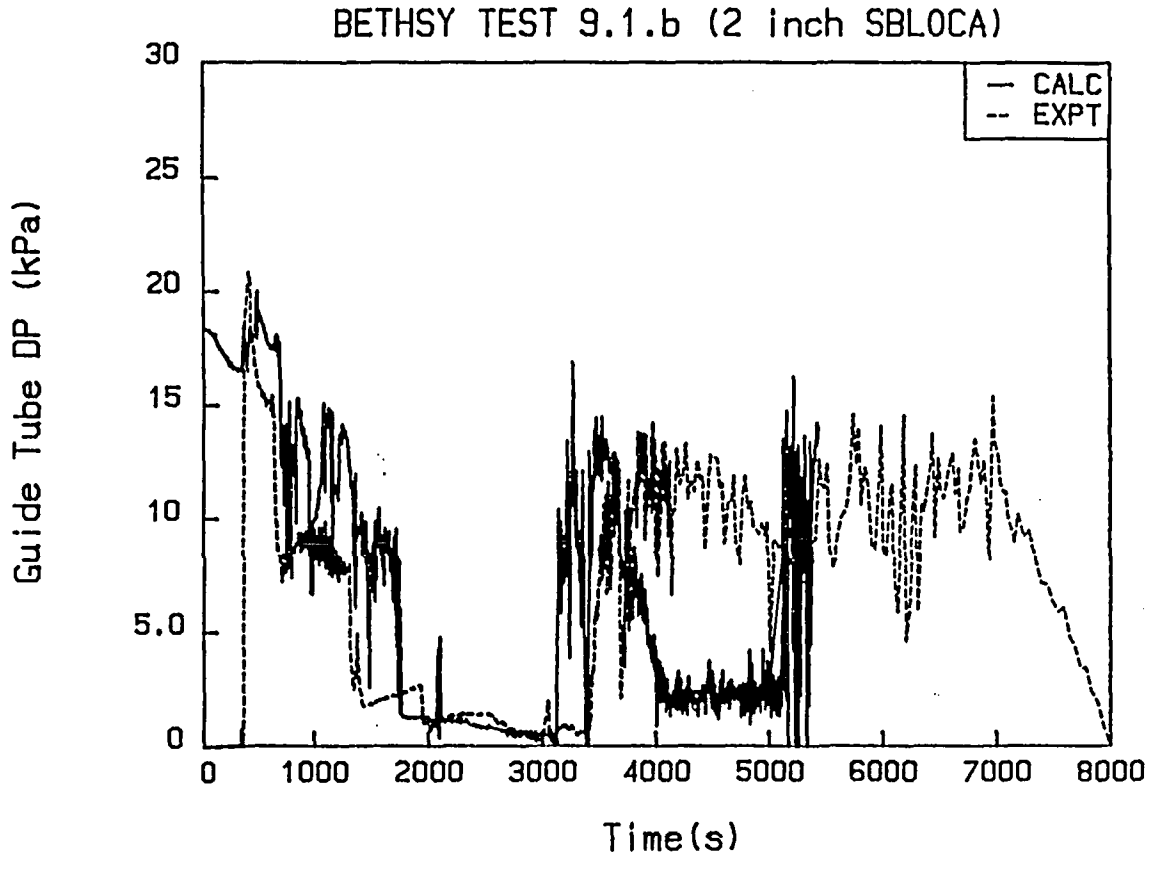

Fig. 40 Guide Tube Diff. Pressure

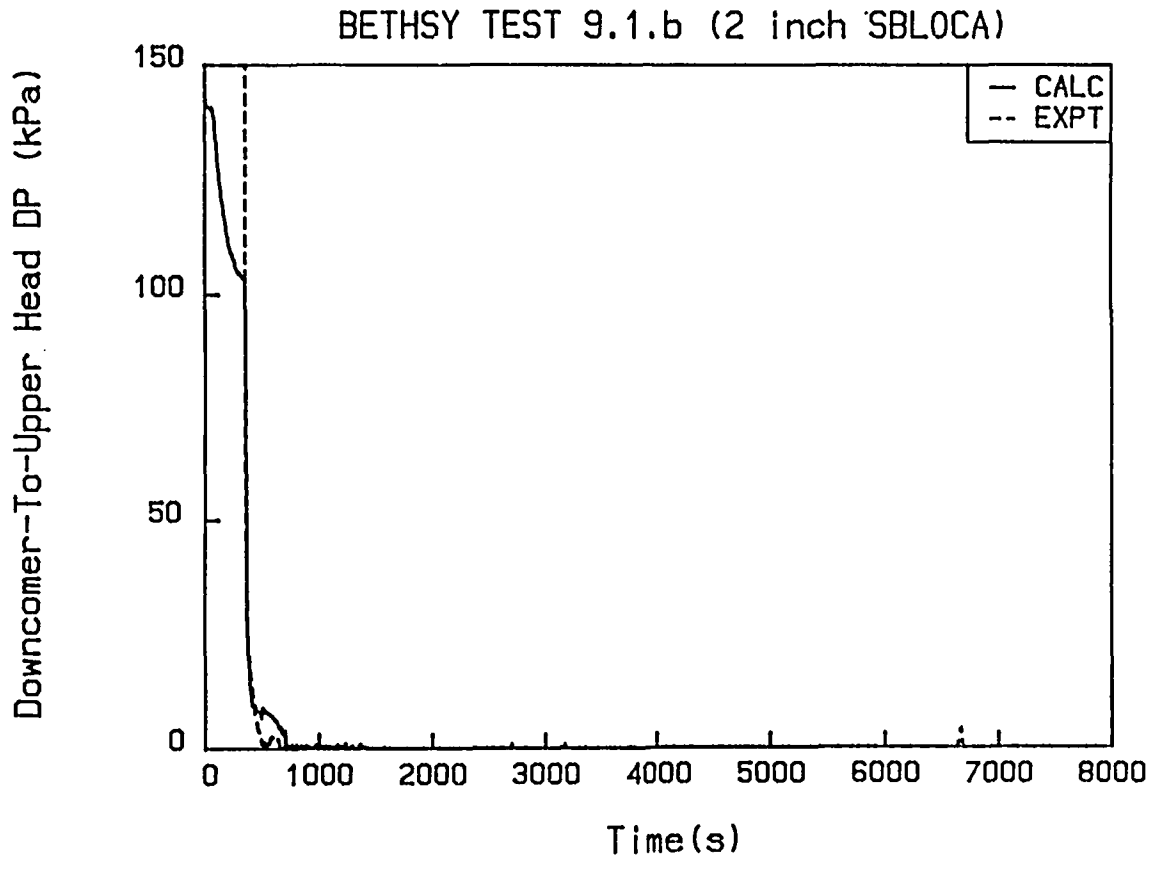

Fig. 41 Downcomer-To-Upper Head Diff. Pressure

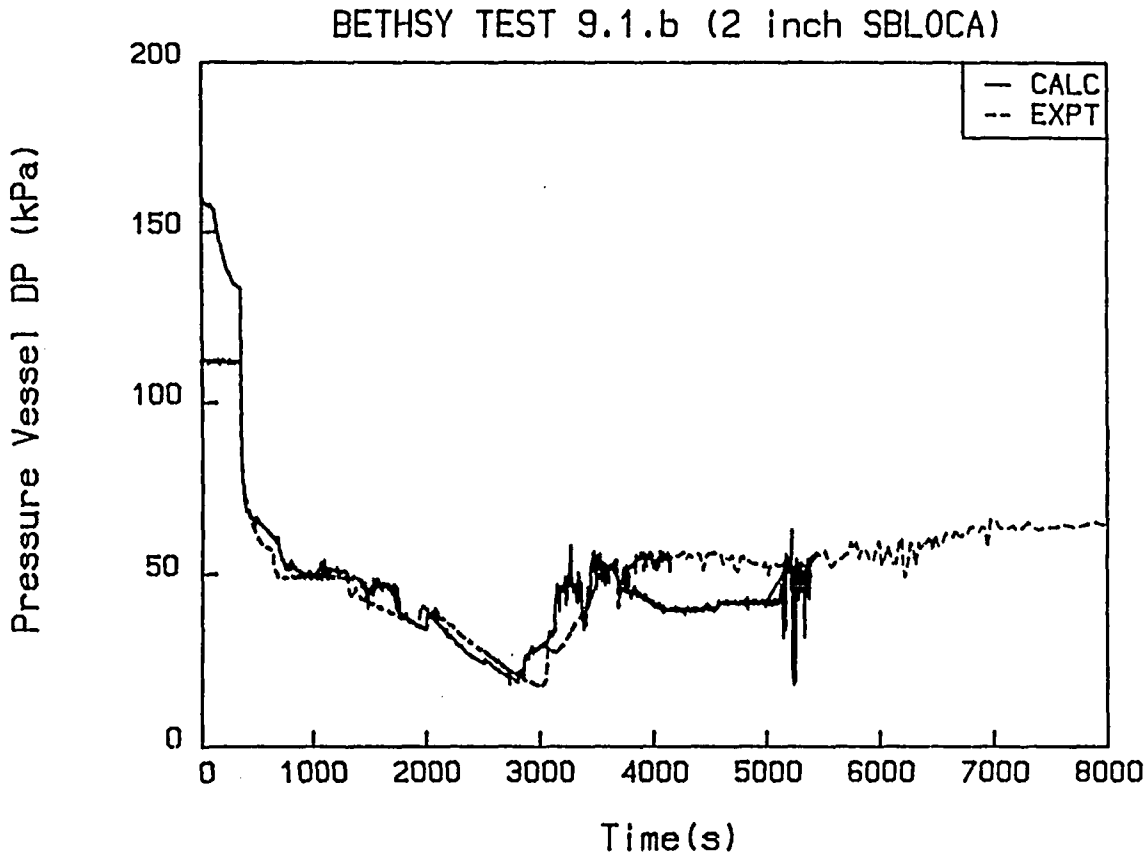

Fig.42 Pressure Vessel Diff. Pressure

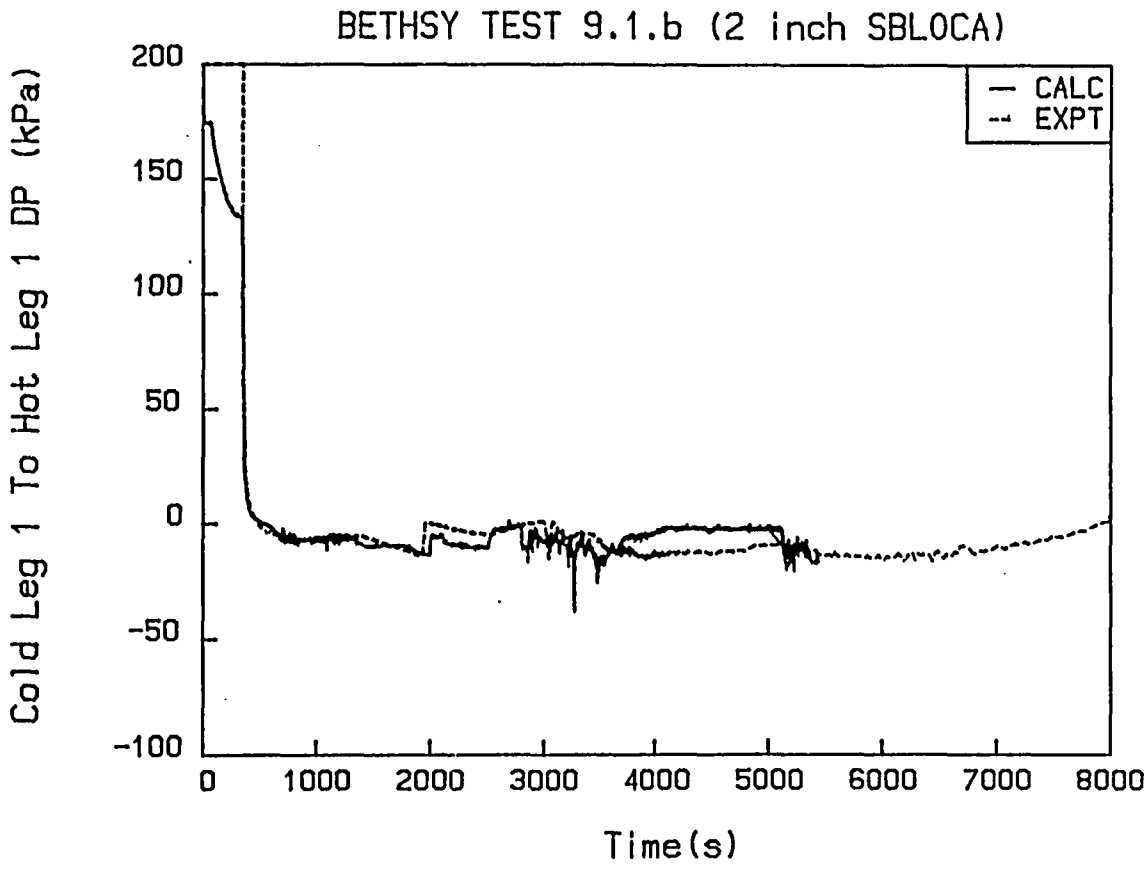

Fig. 43 Cold Leg 1 To Hot Leg 1 Diff. Pressure

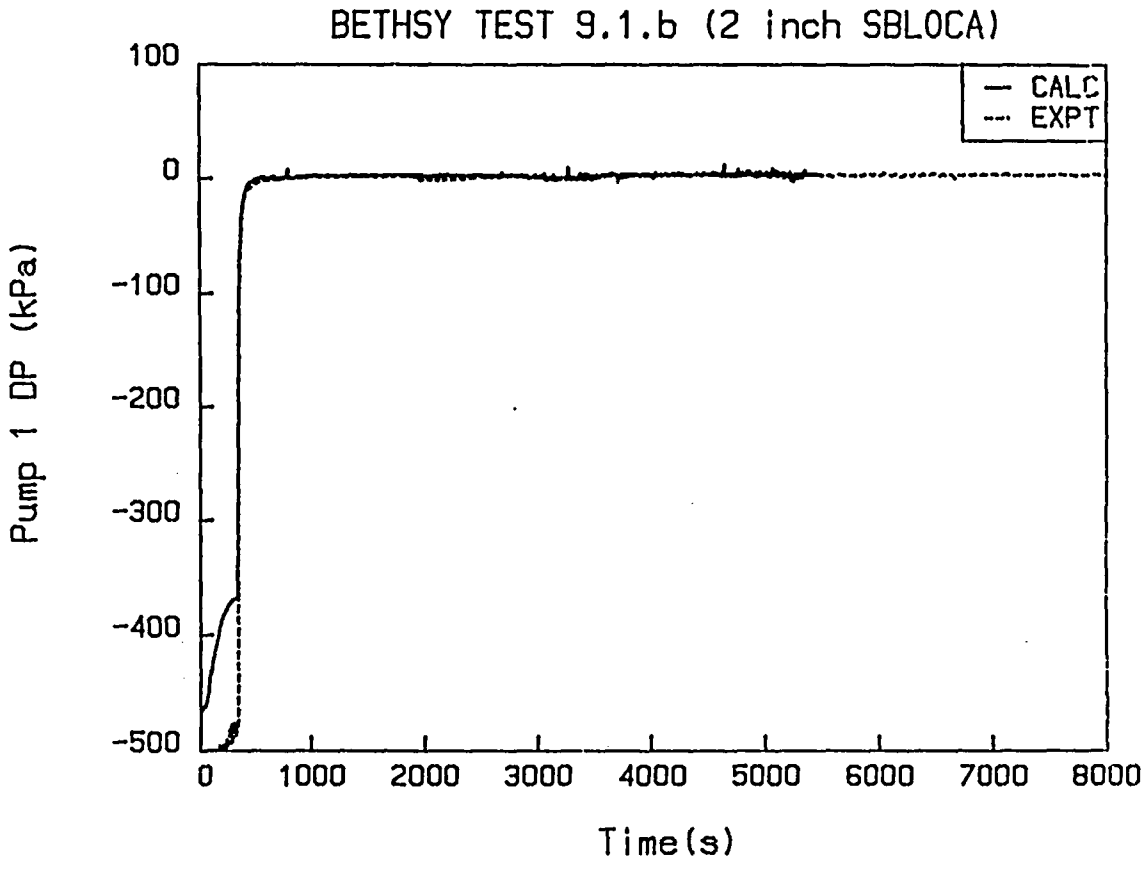

Fig. 44 Pump 1 Diff. Pressure

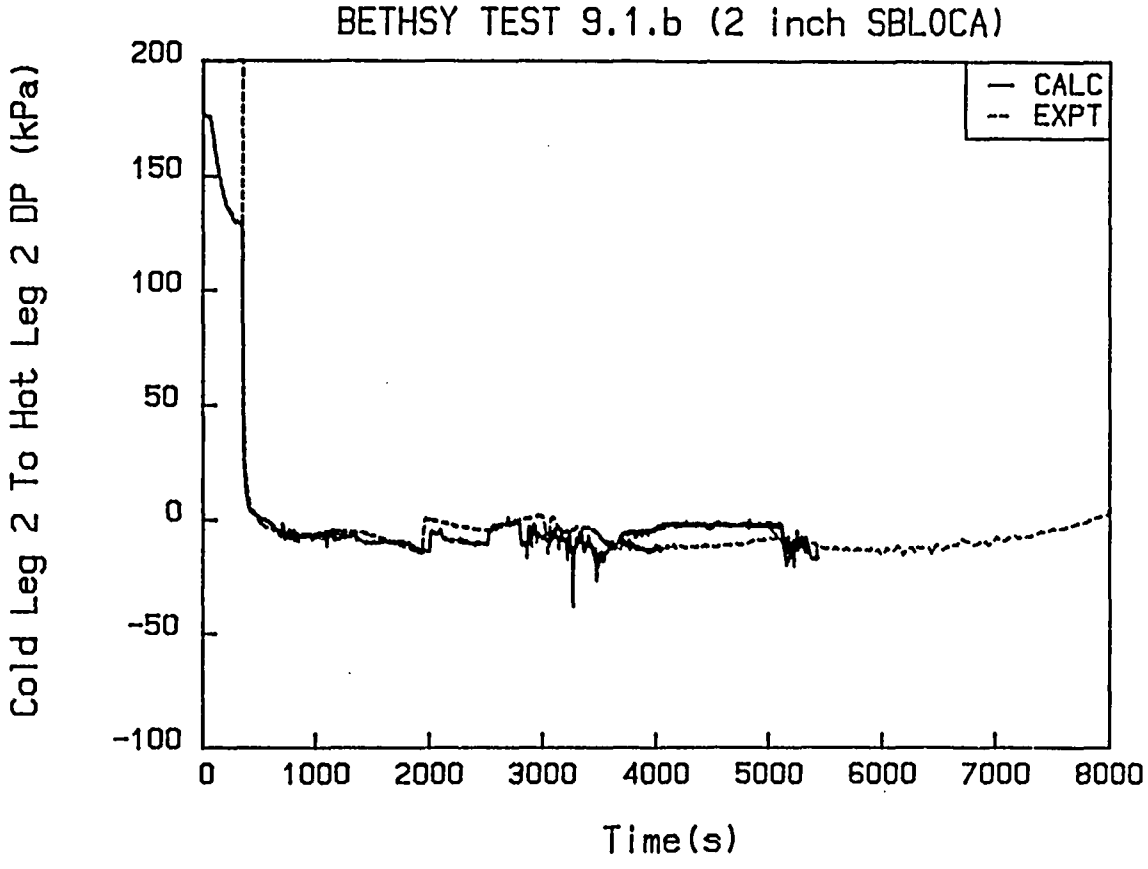

Fig. 45 Cold Leg 2 To Hot Leg 2 Diff. Pressure

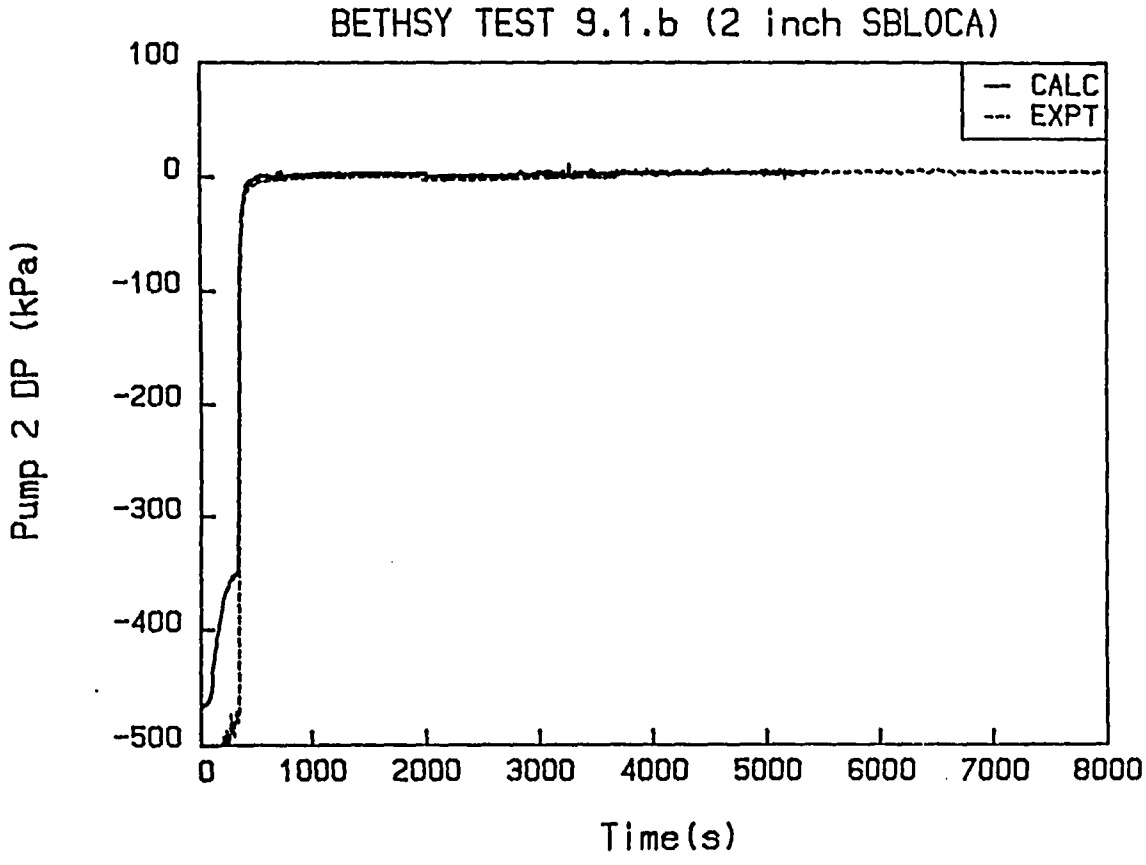

Fig. 46 Pump 2 Diff. Pressure

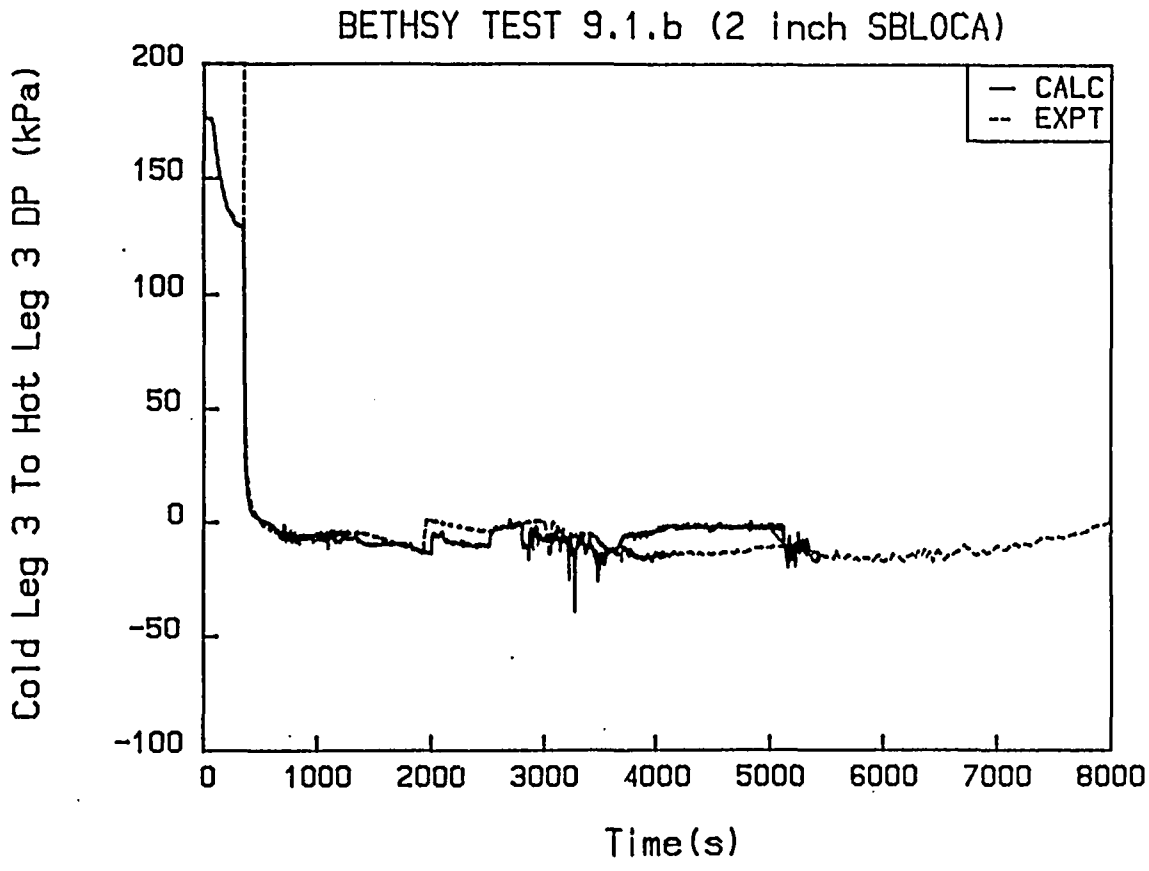

Fig. 47 Cold Leg 3 To Hot Leg 3 Diff. Pressure

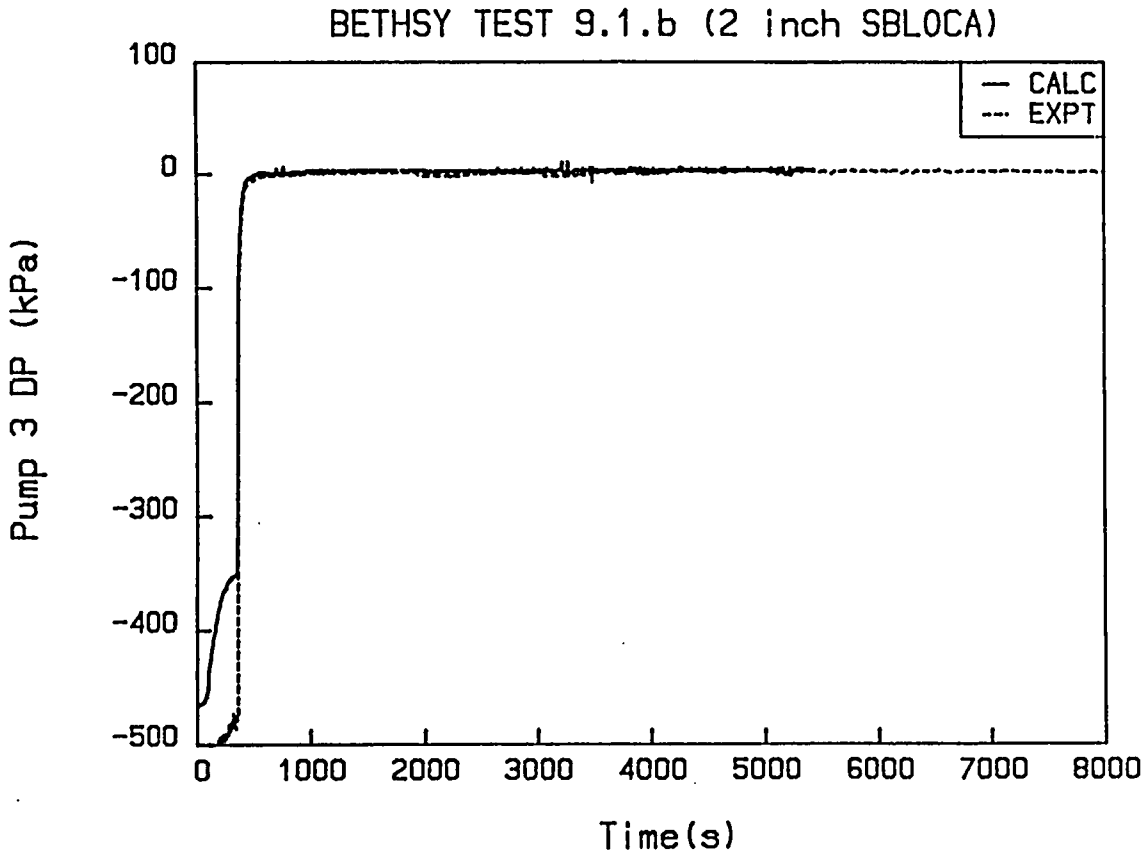

Fig. 48 Pump 3 Diff. Pressure

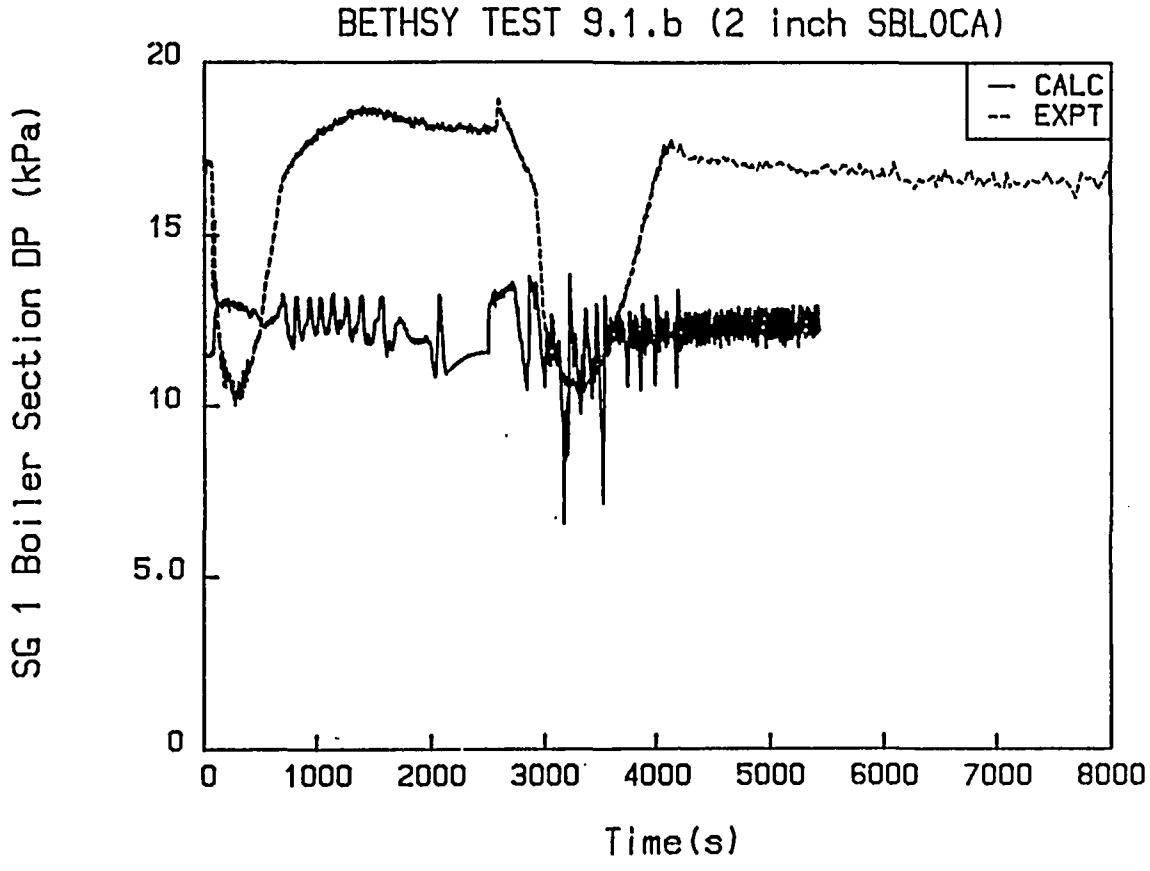

Fig. 49 SG 1 Boiler Section Diff. Pressure

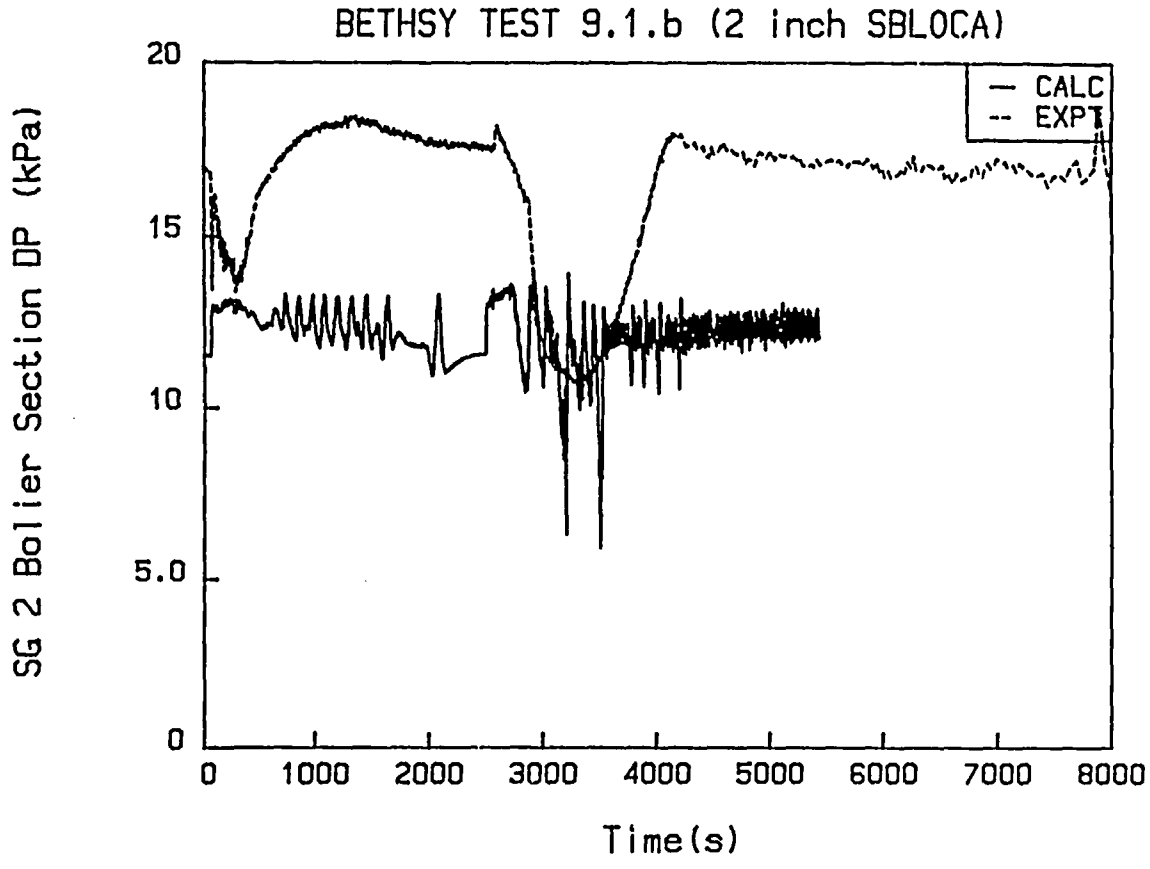

Fig. 50 SG 2 Bolier Section Diff. Pressure

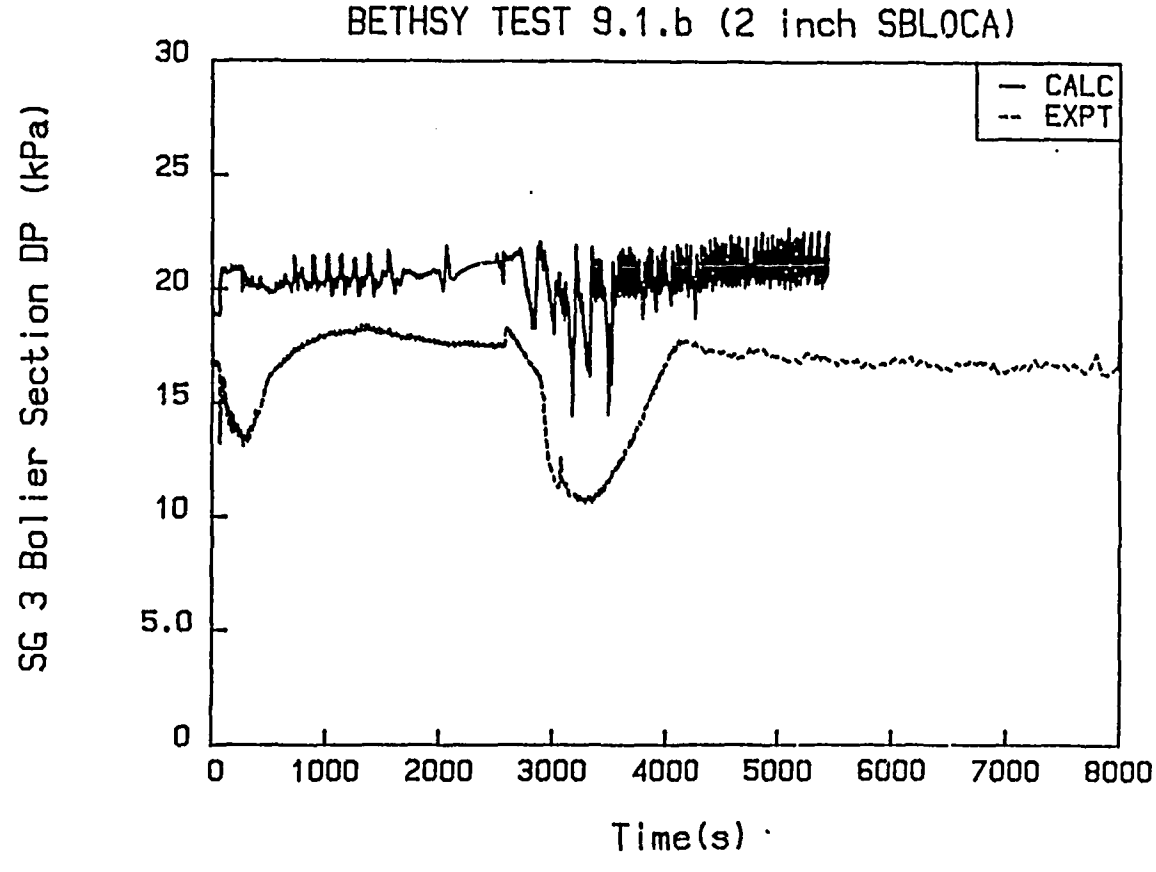

Fig. 51 SG 3 Bolier Section Diff. Pressure

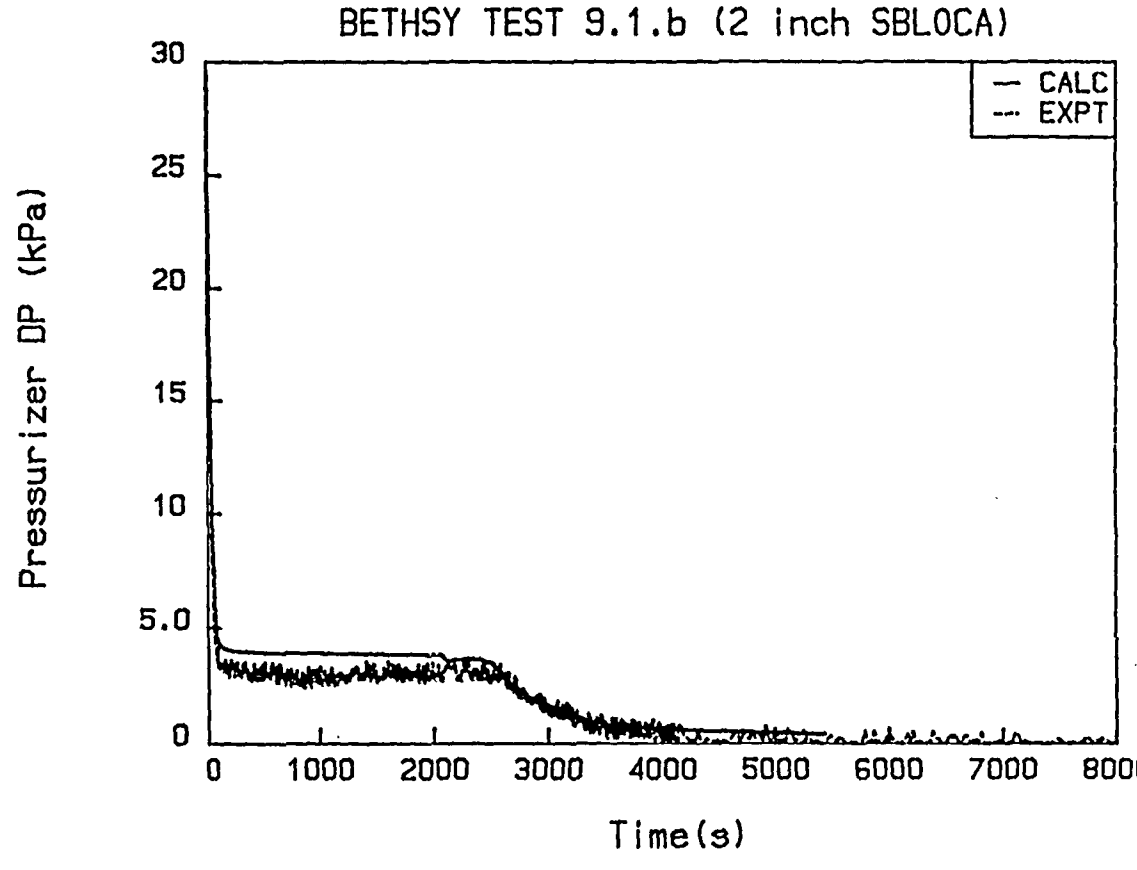

Fig. 52 Pressurizer Diff. Pressure

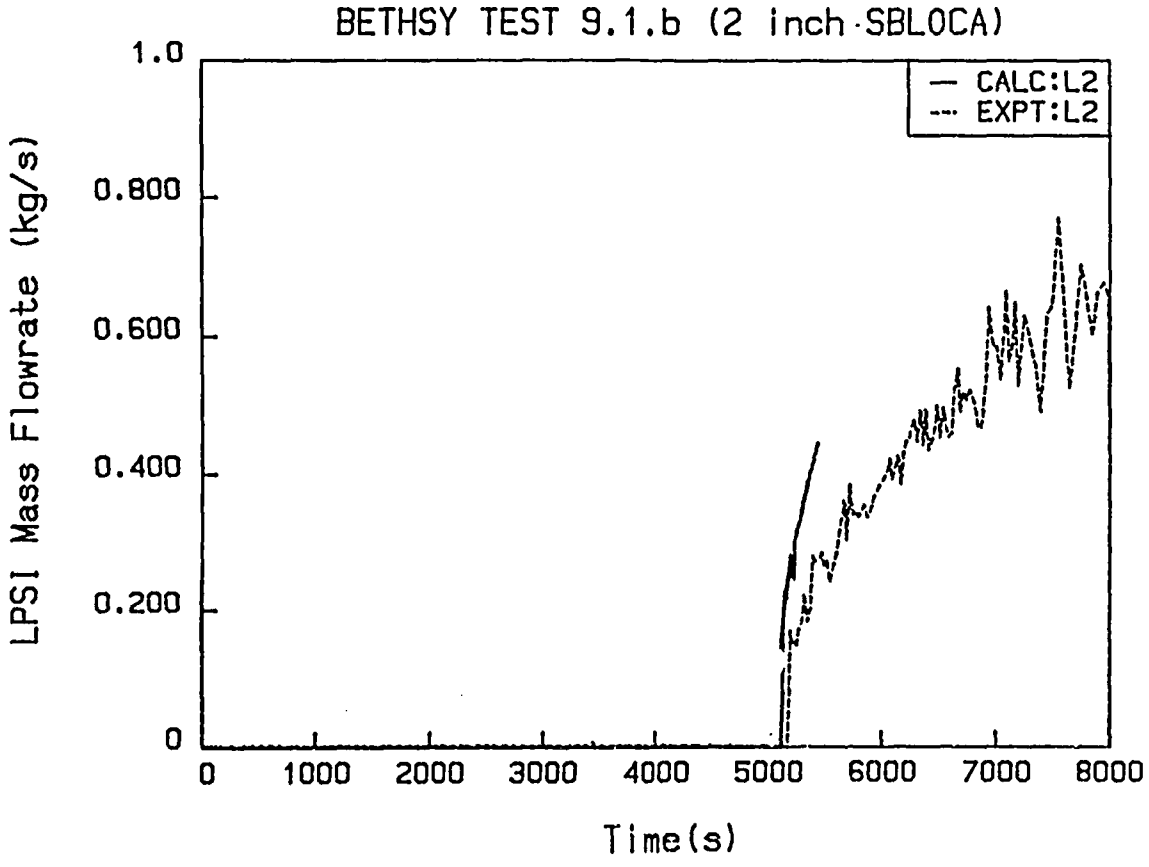

Fig. 53 LPSI Mass Flowrate

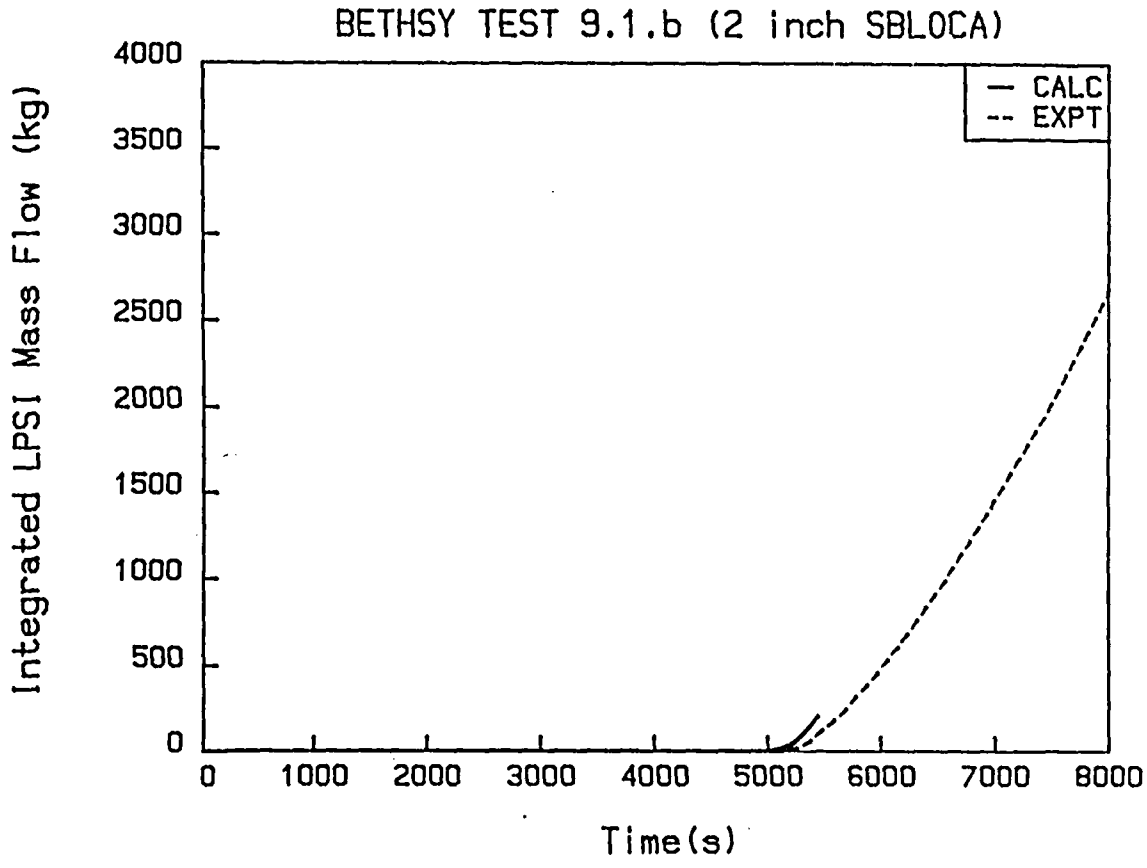

Fig. 54 Integrated LPSI Mass Flow

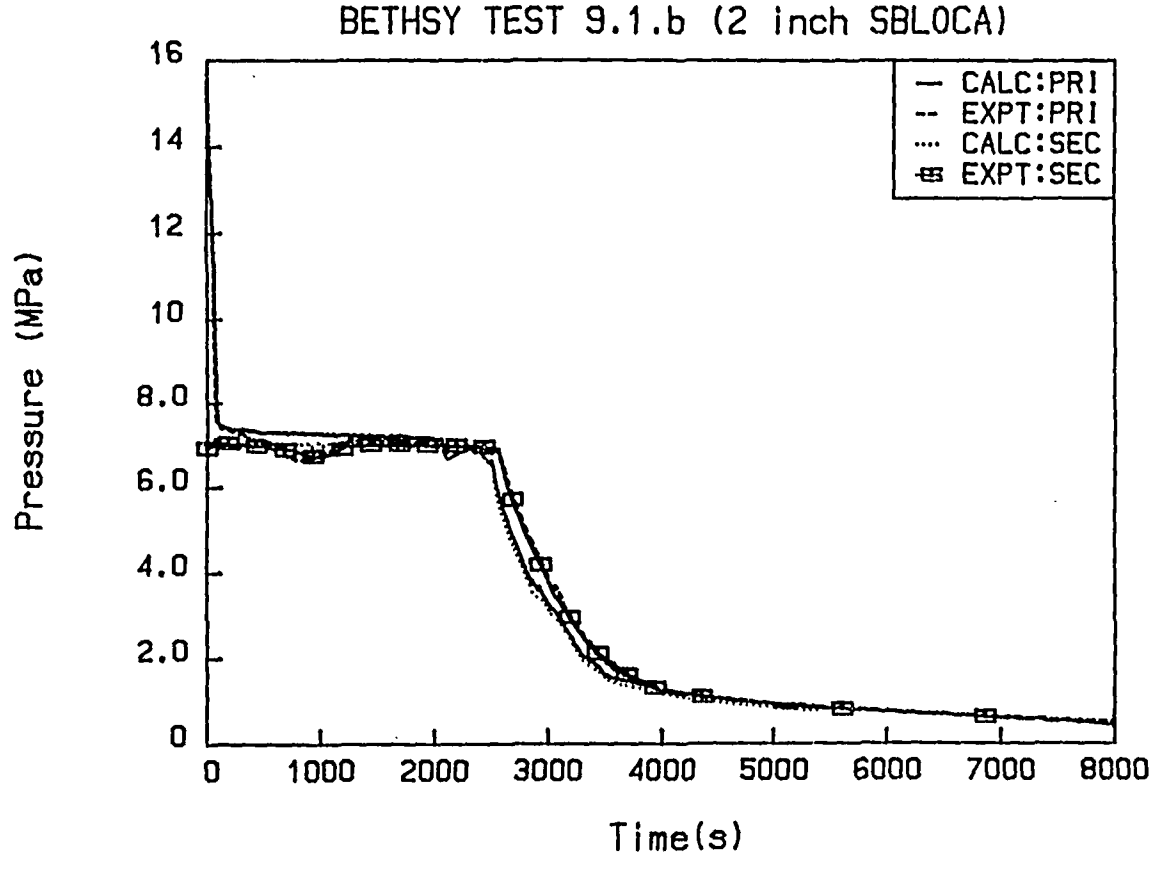

Fig. 55 Primary and Secondary Pressure

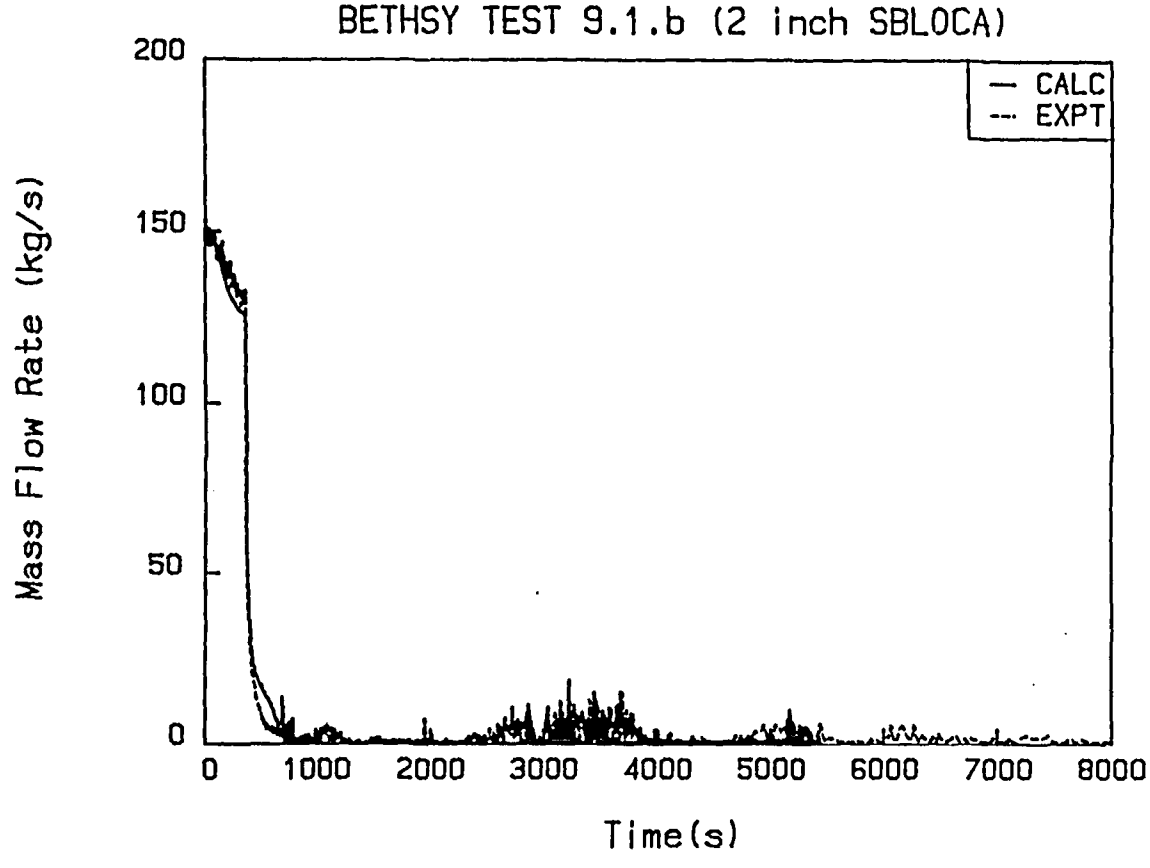

Fig. 56 Mass Flow Rate

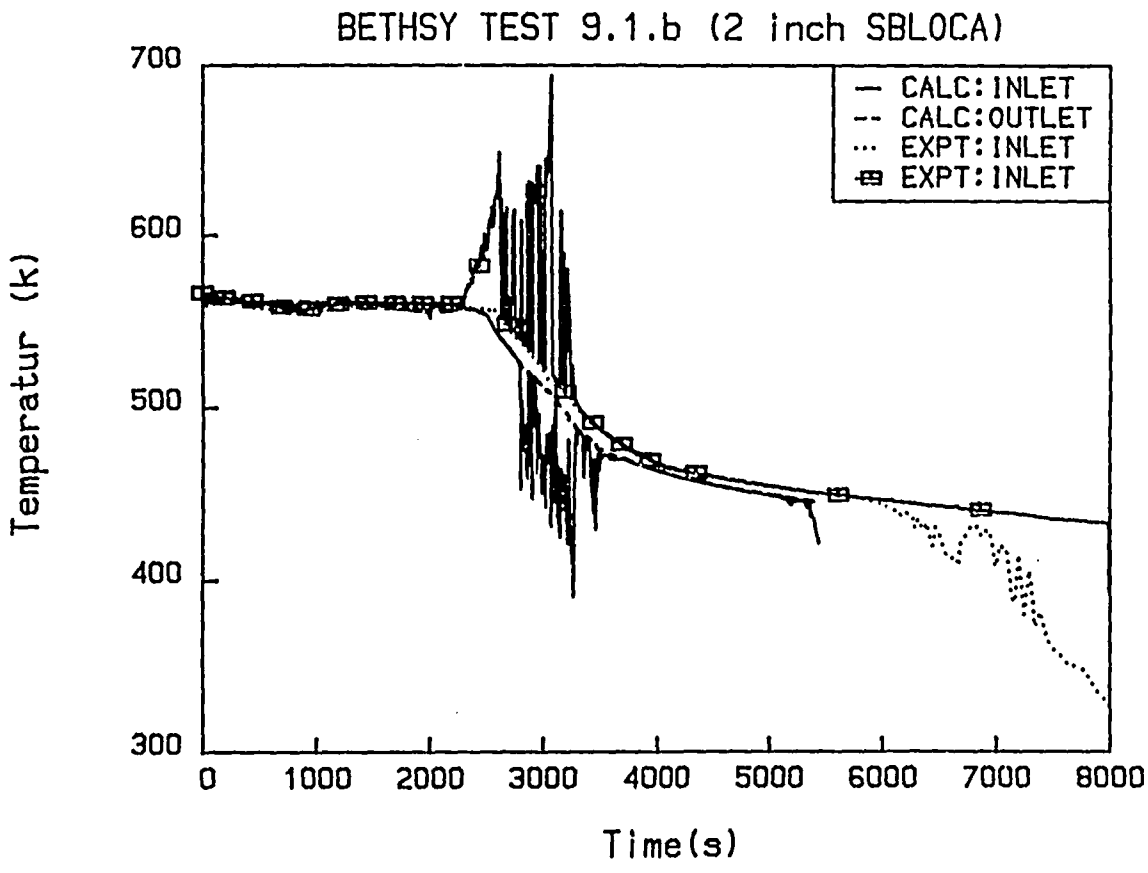

Fig. 57 Core Inlet & Outlet Tempertures

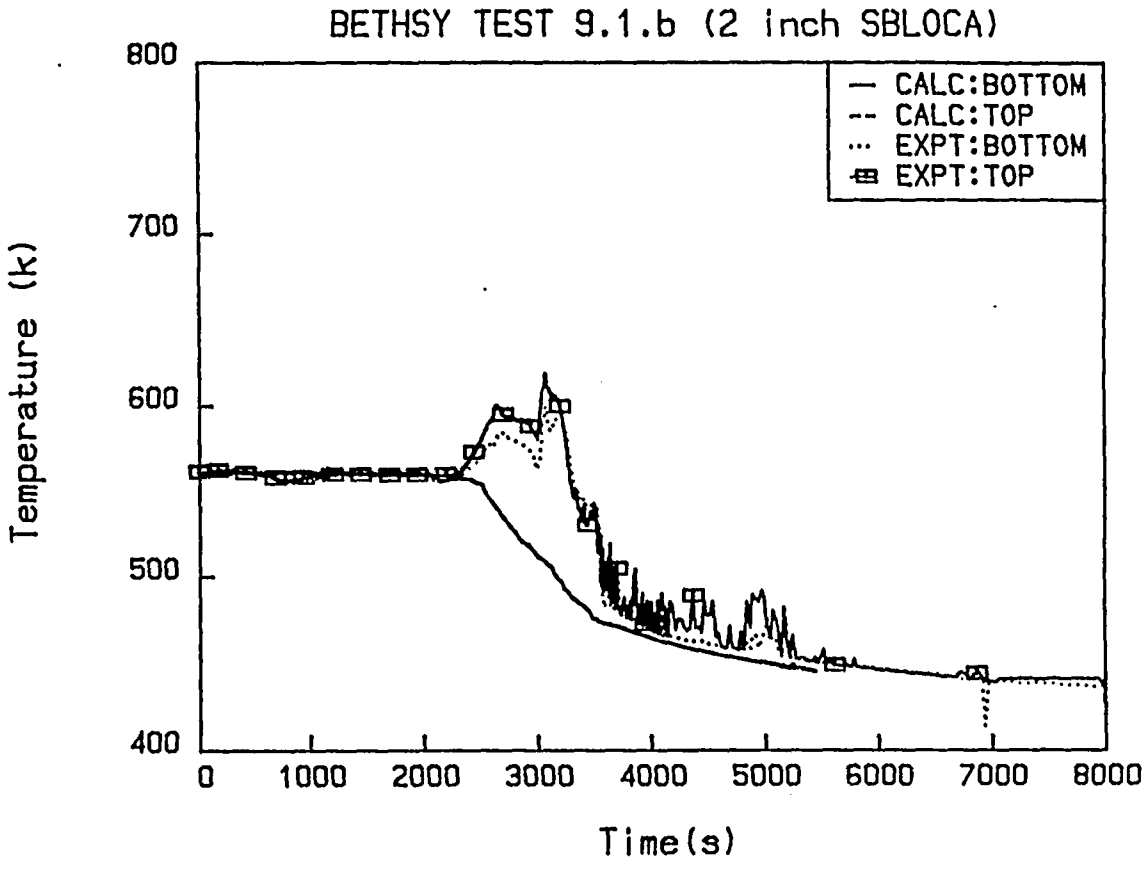

Fig. 58 Upper Head Temperatures

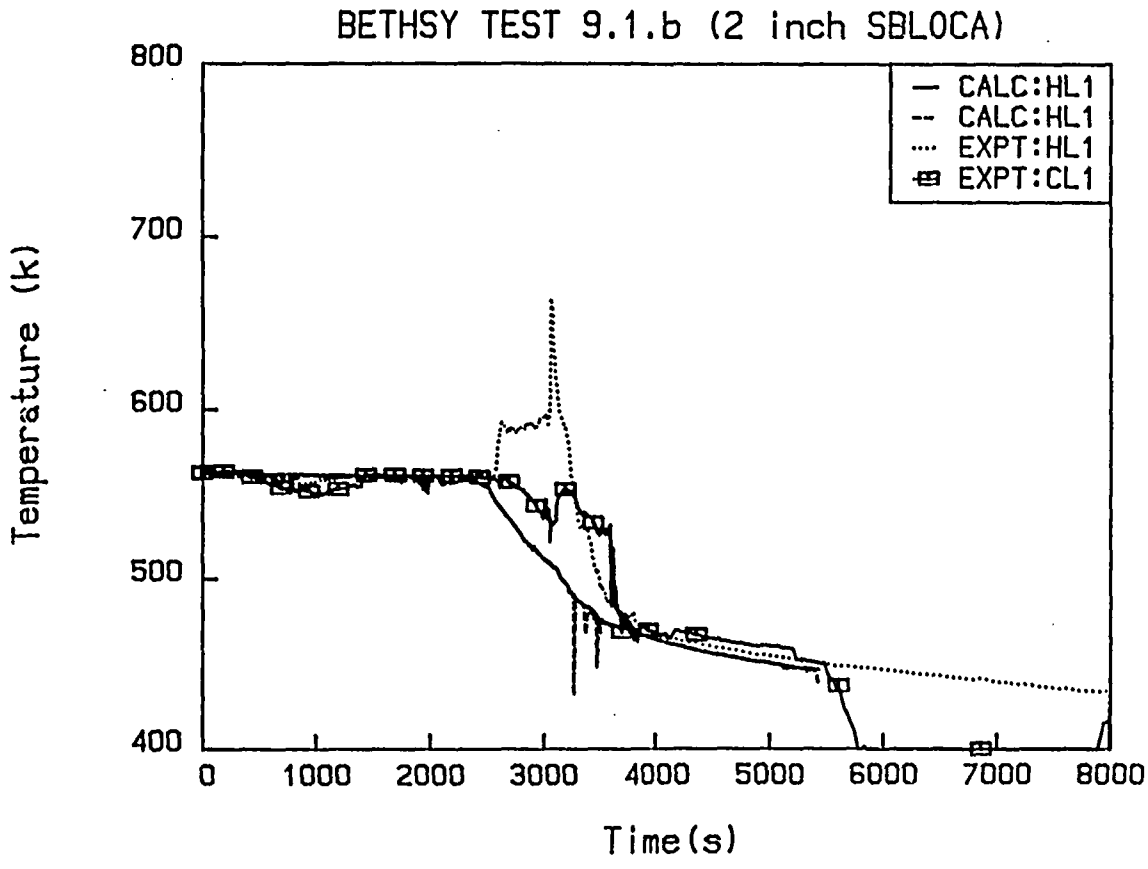

Fig. 59 Loop 1 Temperature

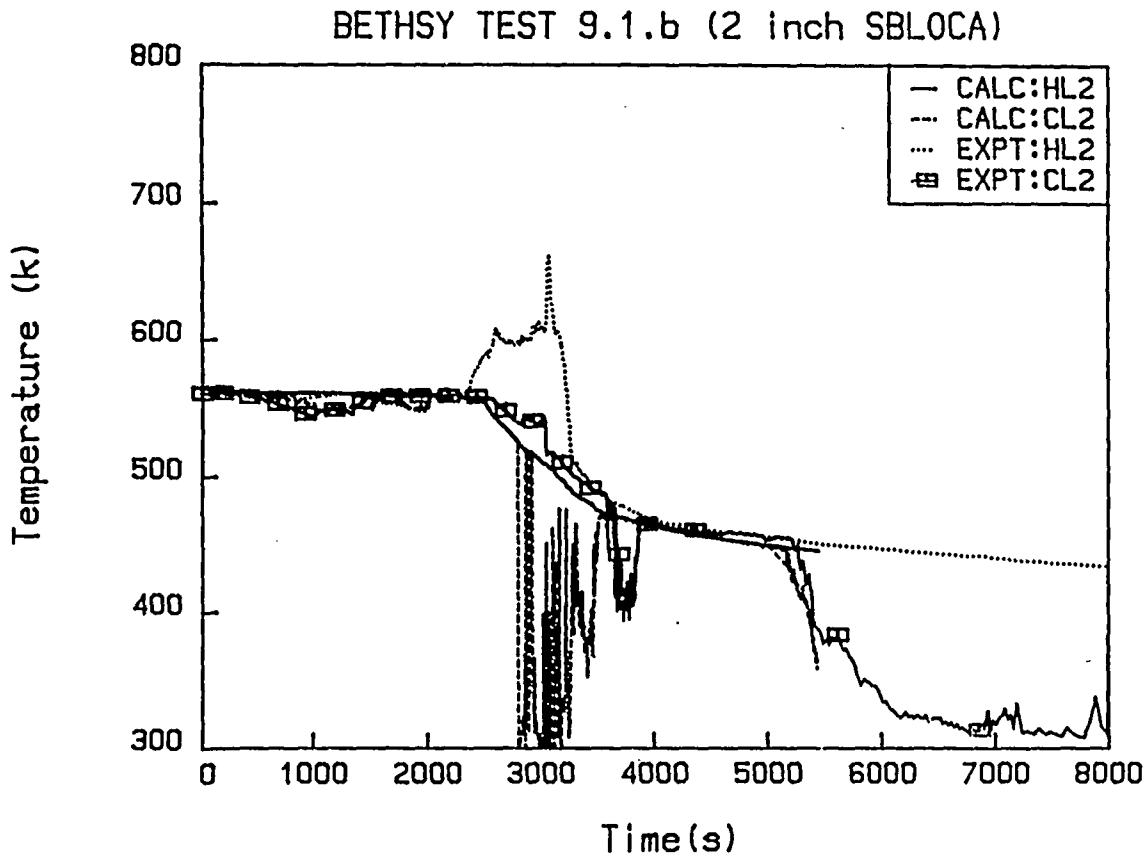

Fig. 60 Loop 2 Temperature

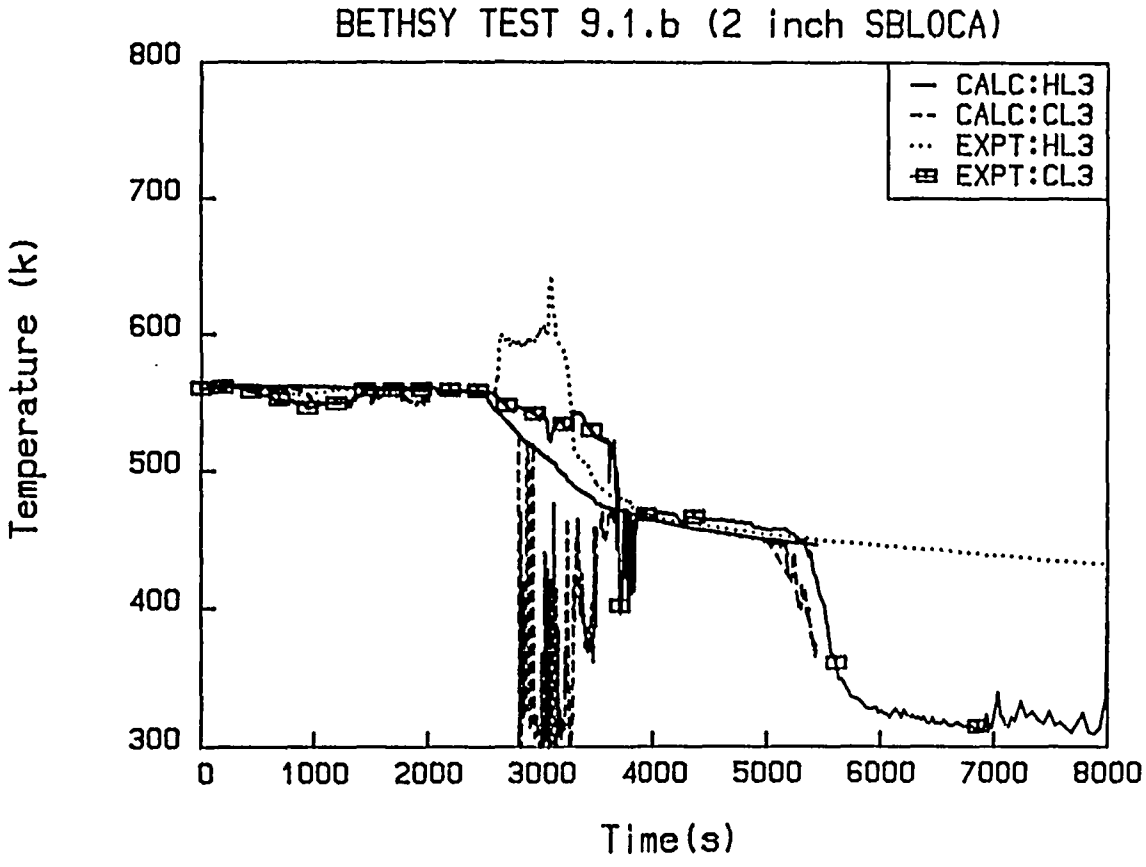

Fig. 61 Loop 3 Temperature

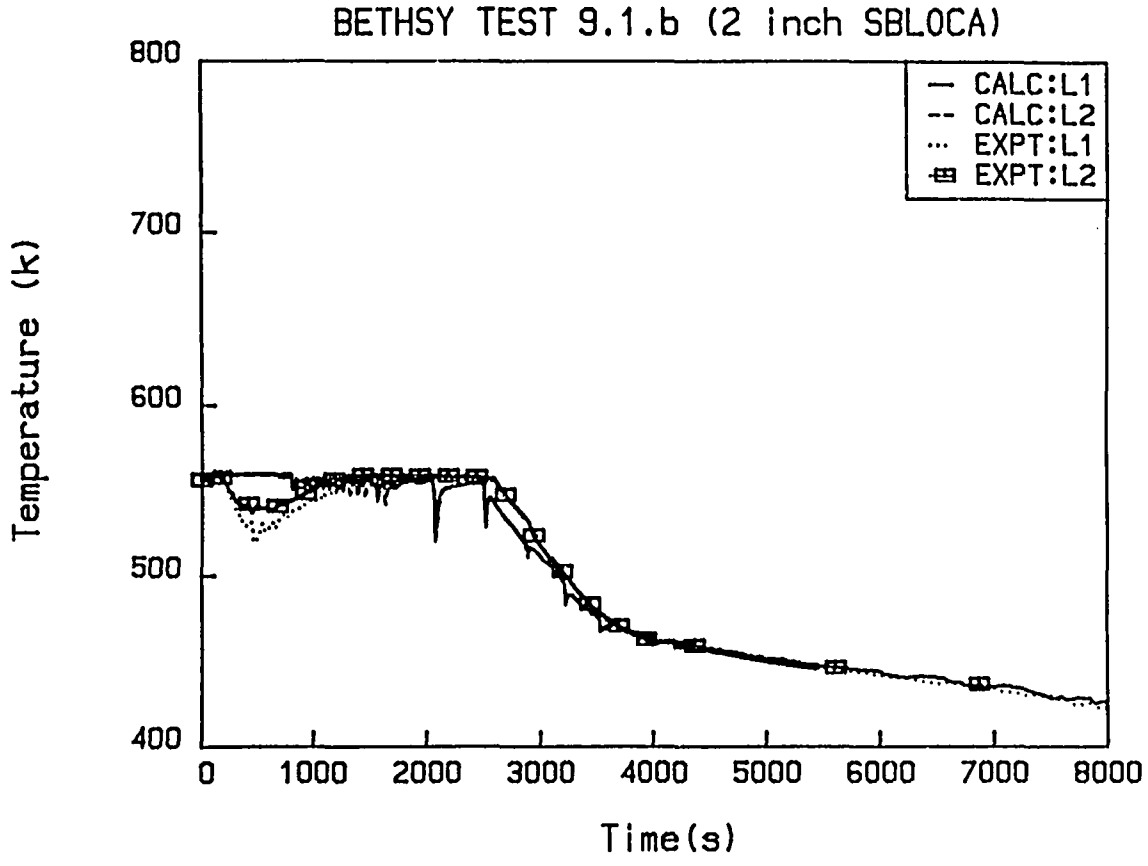

Fig. 62 Bottom SG Downcomer Temperature

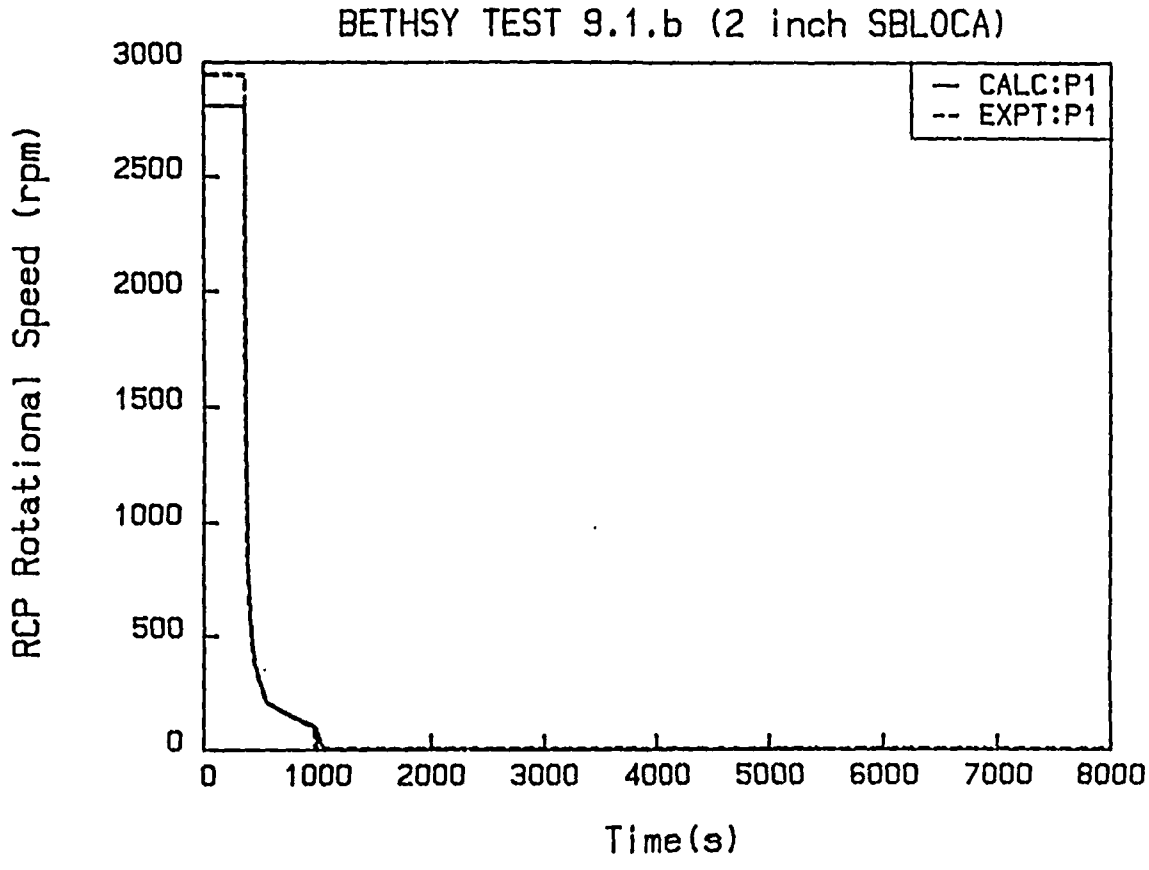

Fig. 63 RCP Rotational Speed

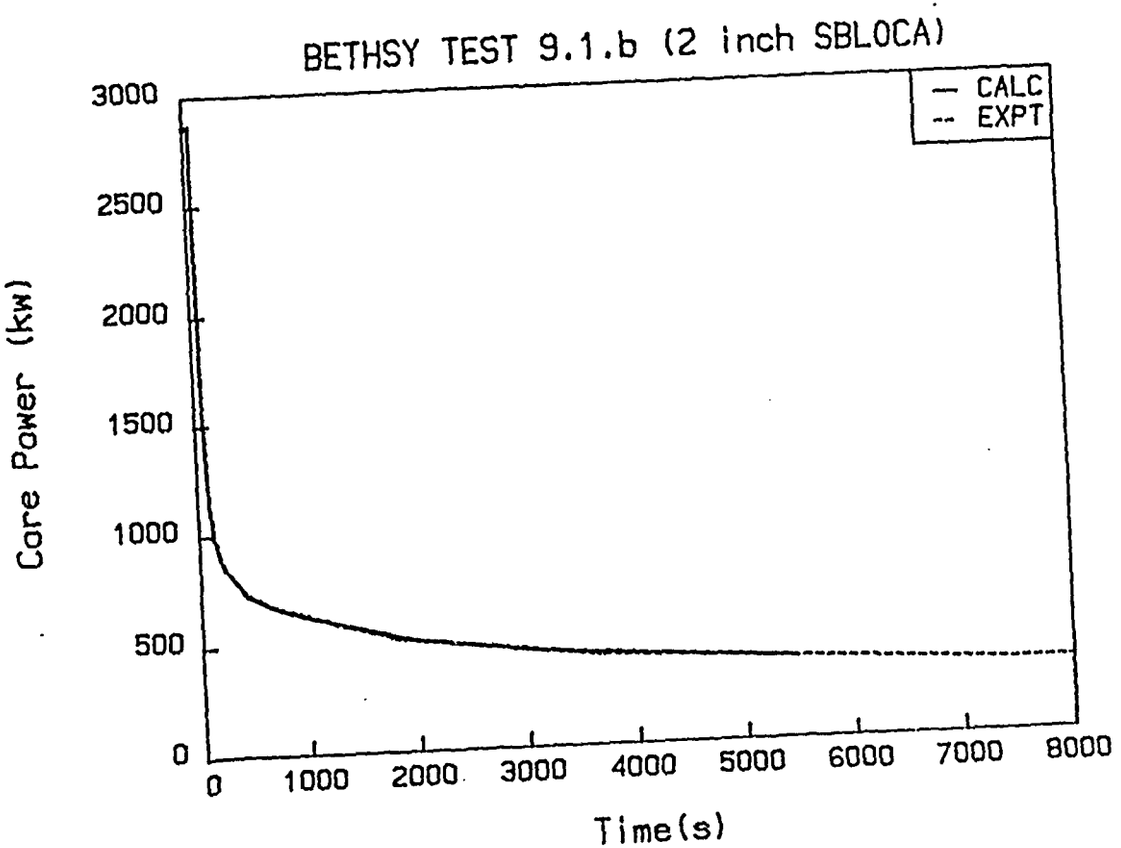

Fig. 64 Core Power

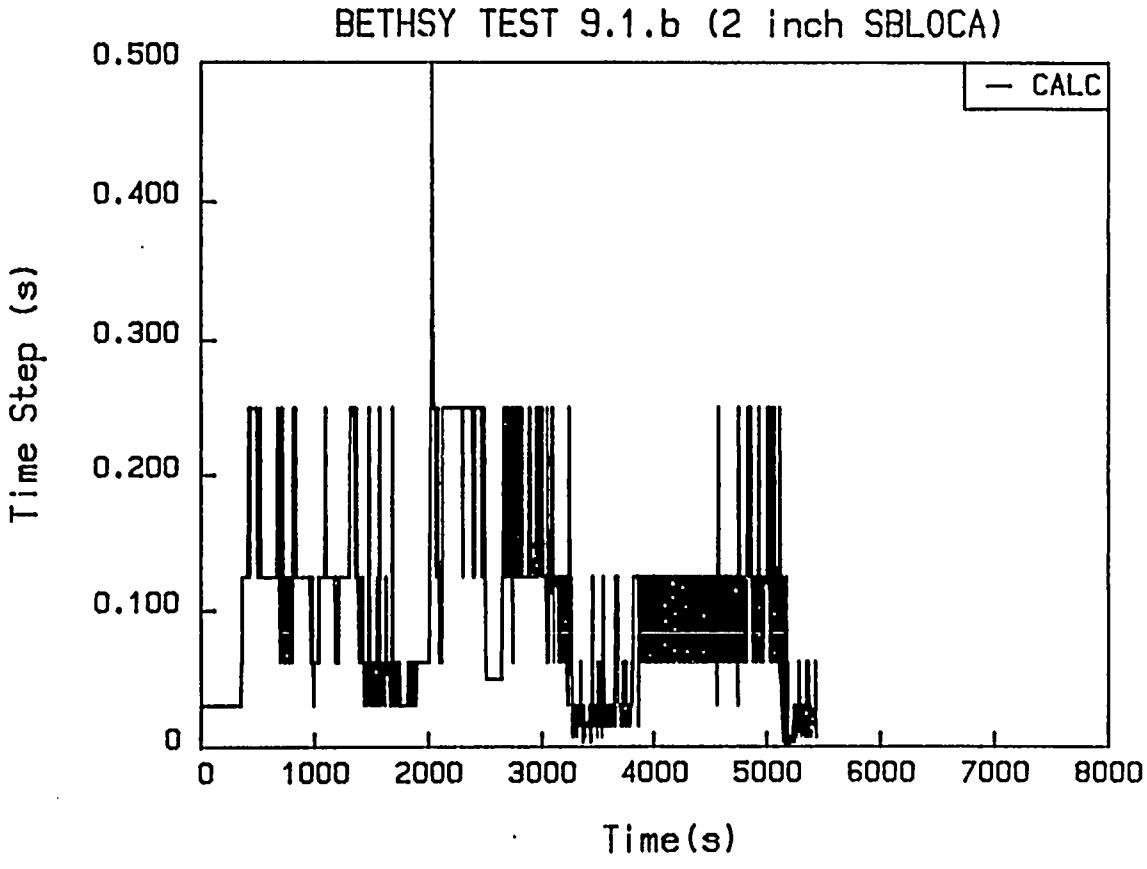

Fig. 65 Time Step

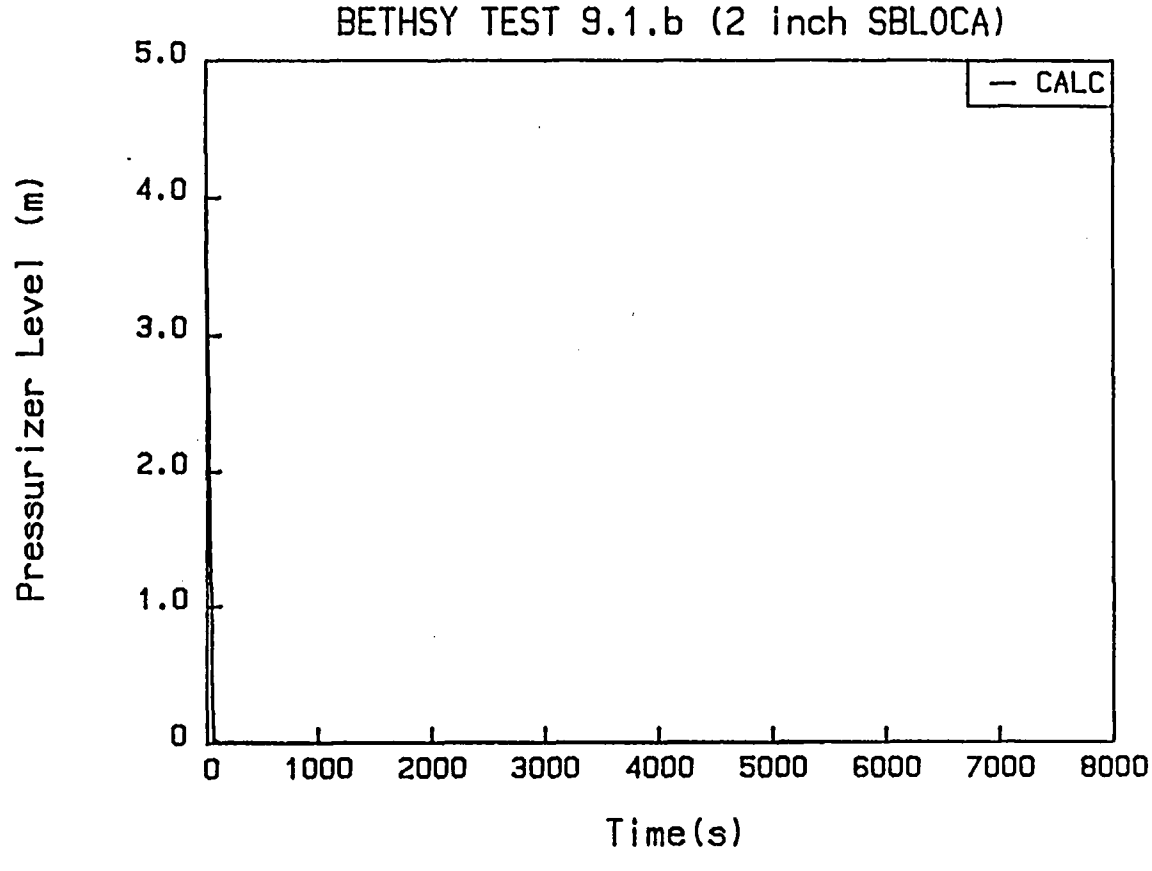

Fig. 66 Pressurizer Level

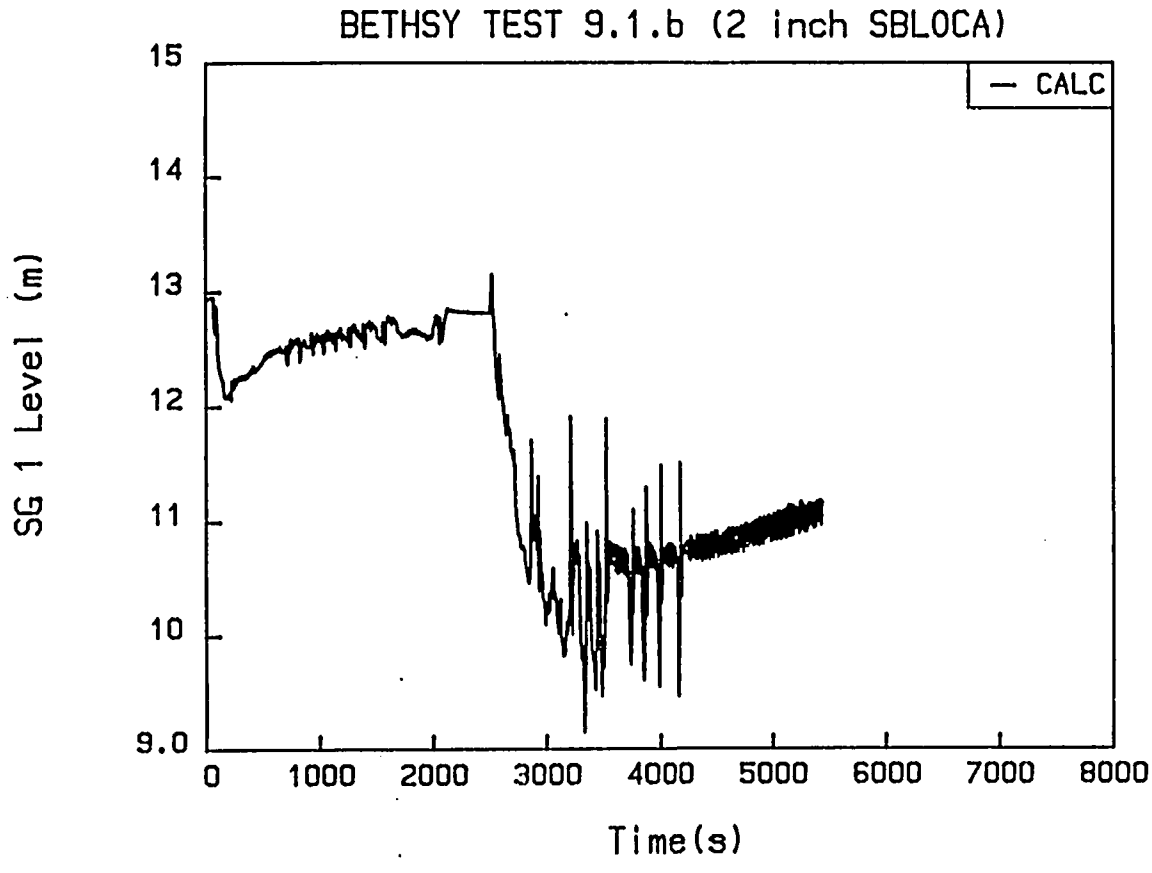

Fig. 67 SG 1 Wide Range Level

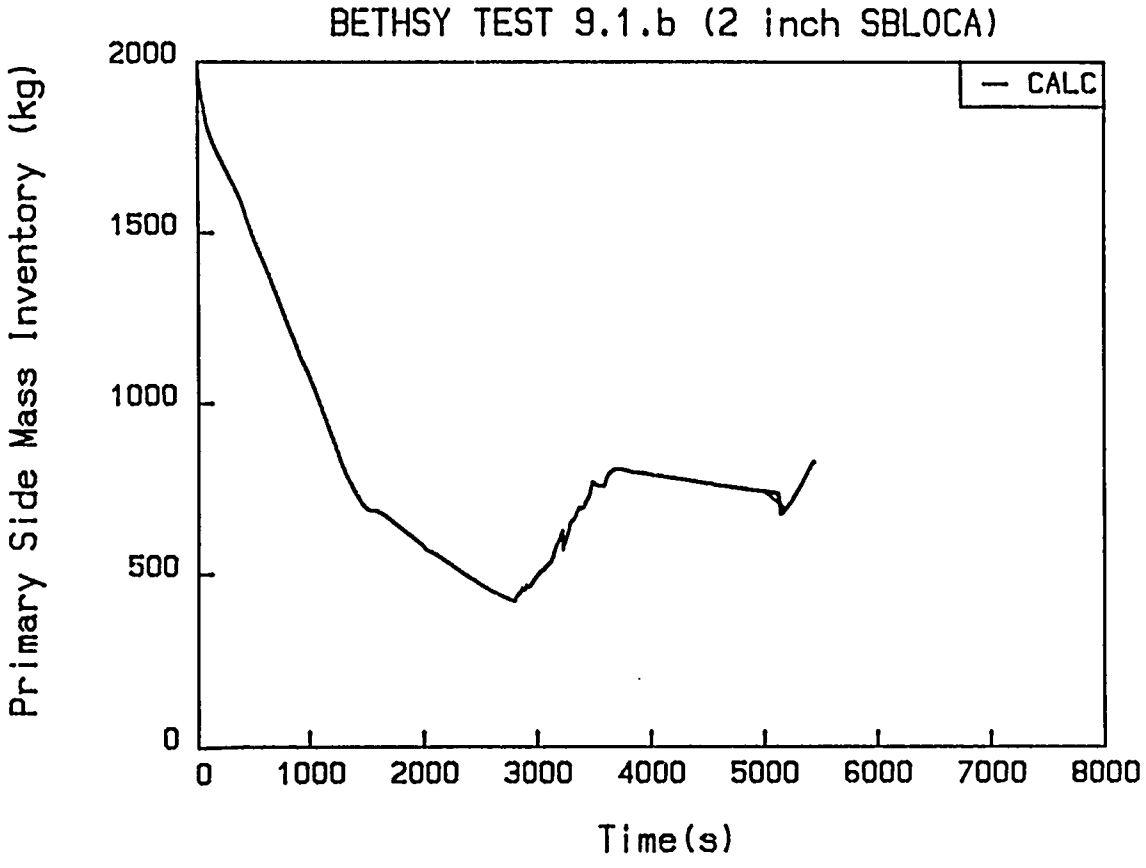

Fig. 68 Primary Side Mass Inventory

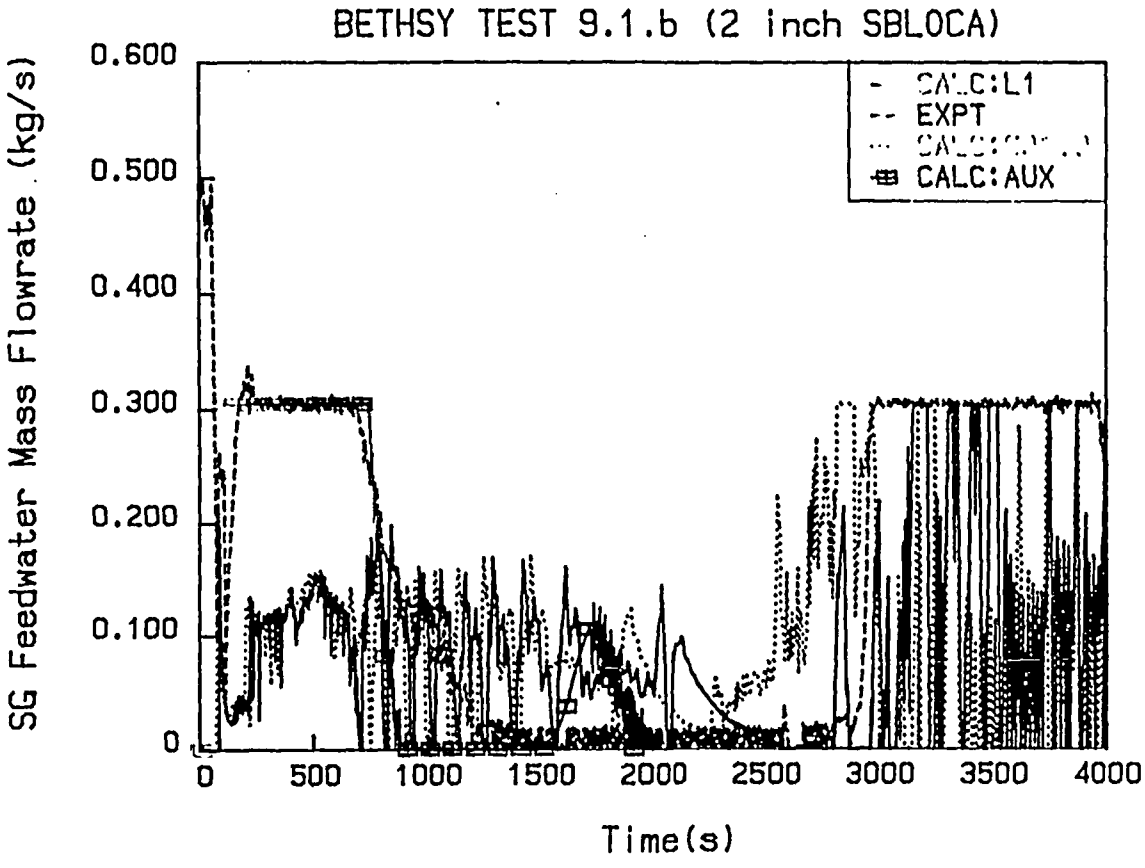

Fig. 69 SG Feedwater Mass Flowrate

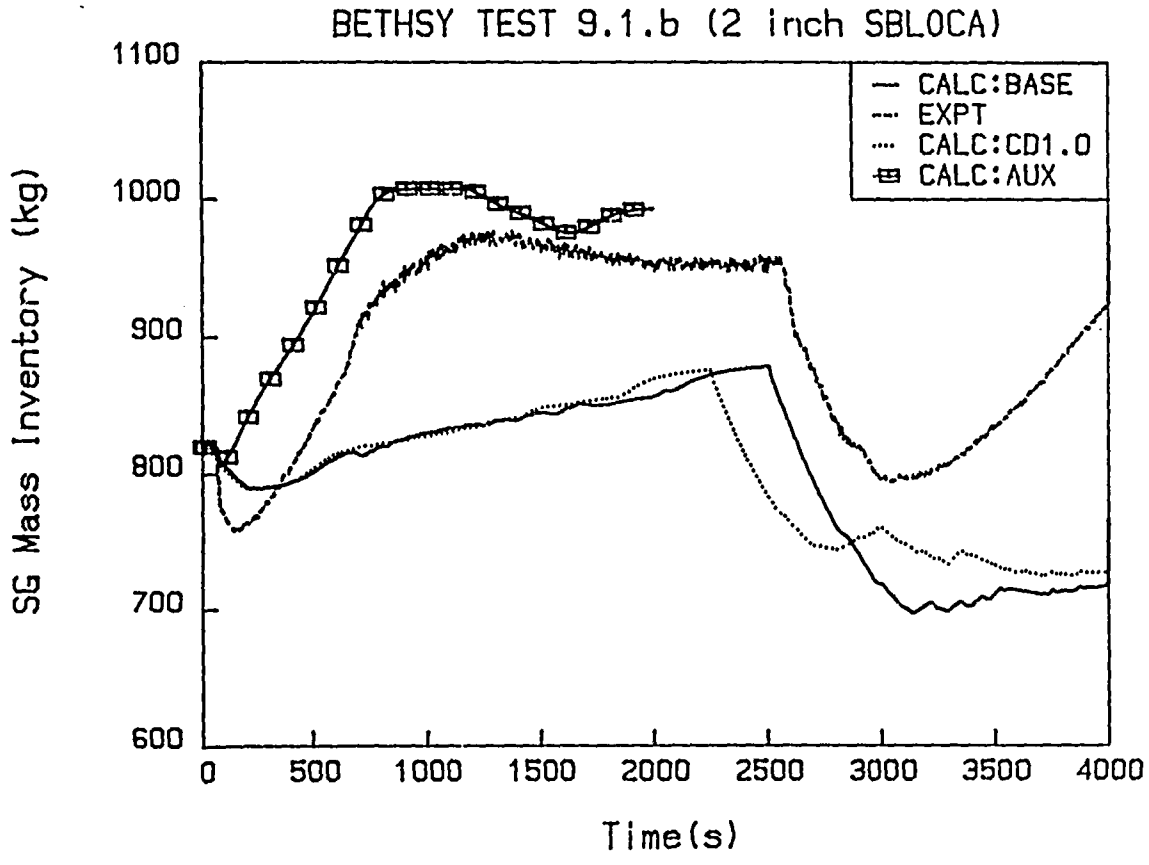

Fig. 70 SG Mass Inventory

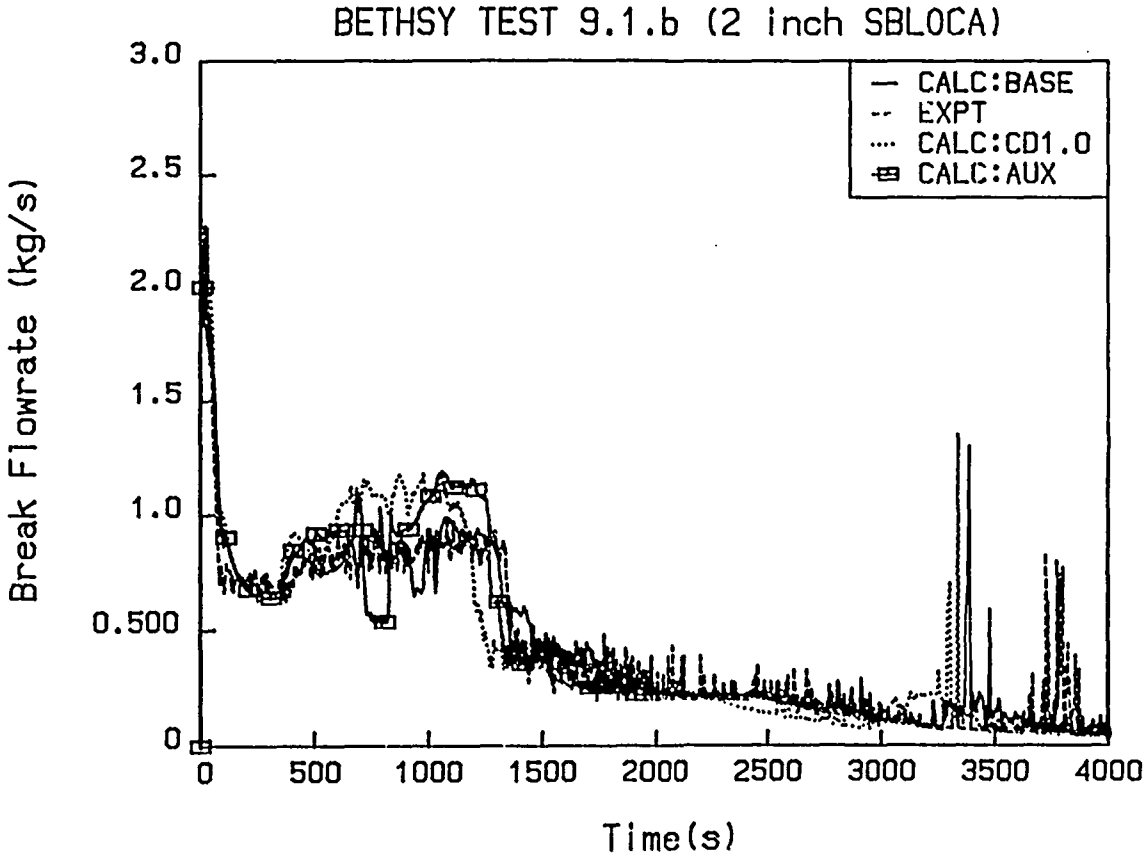

Fig. 71 Break Flowrate

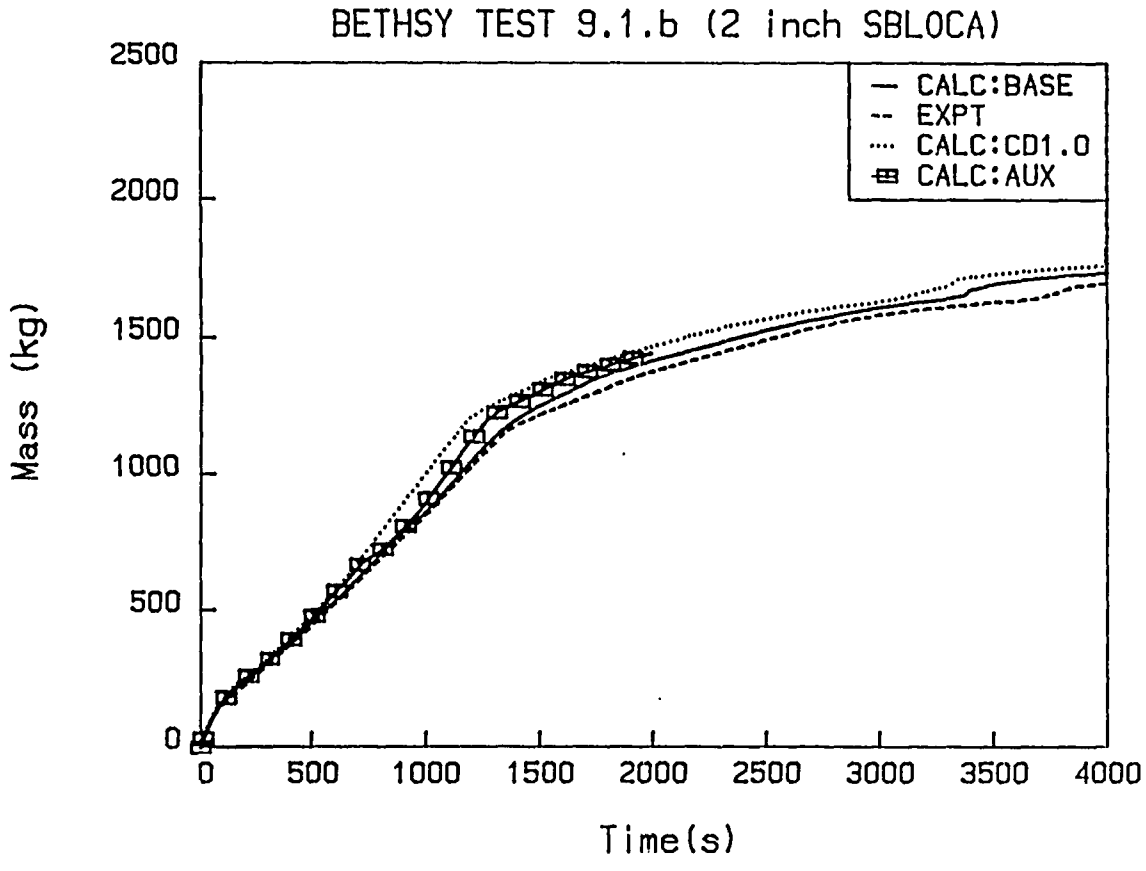

Fig. 72 Integrated Break Mass Flow

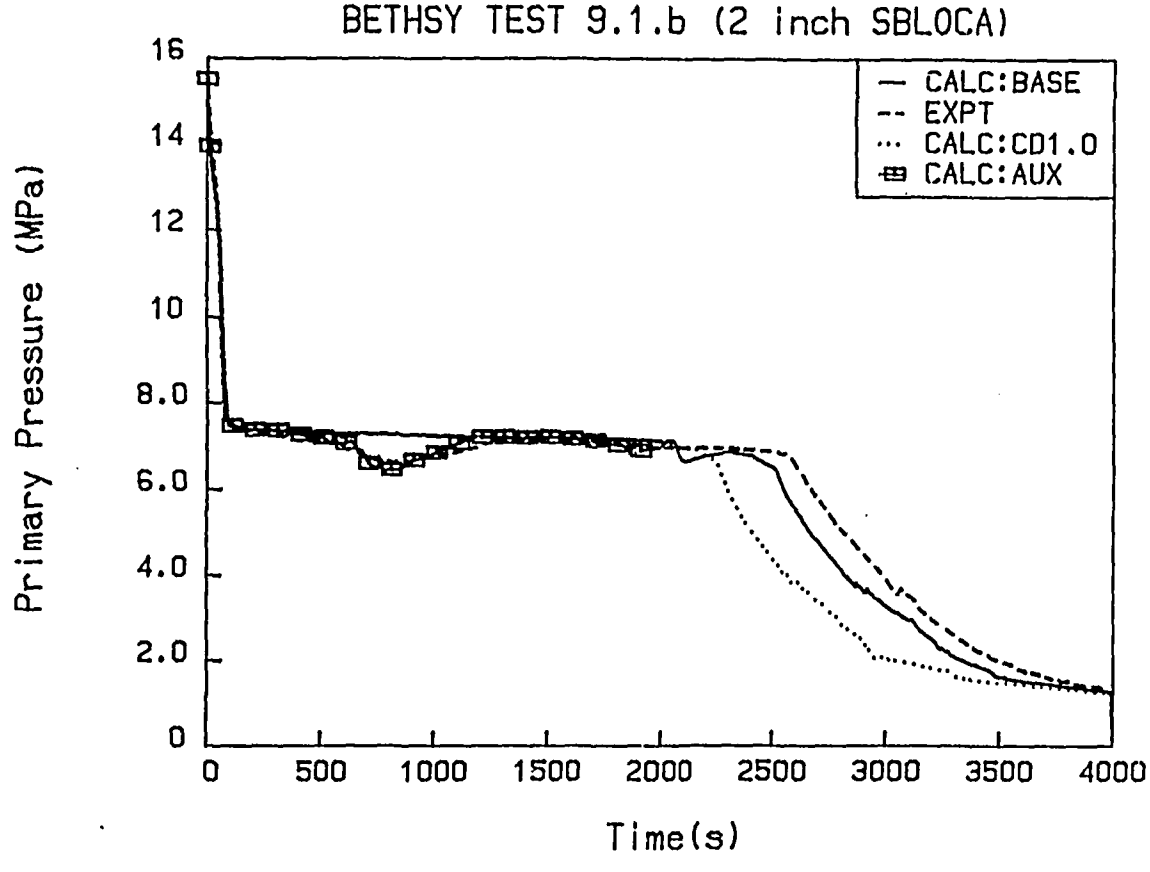

Fig. 73 Primary Pressure

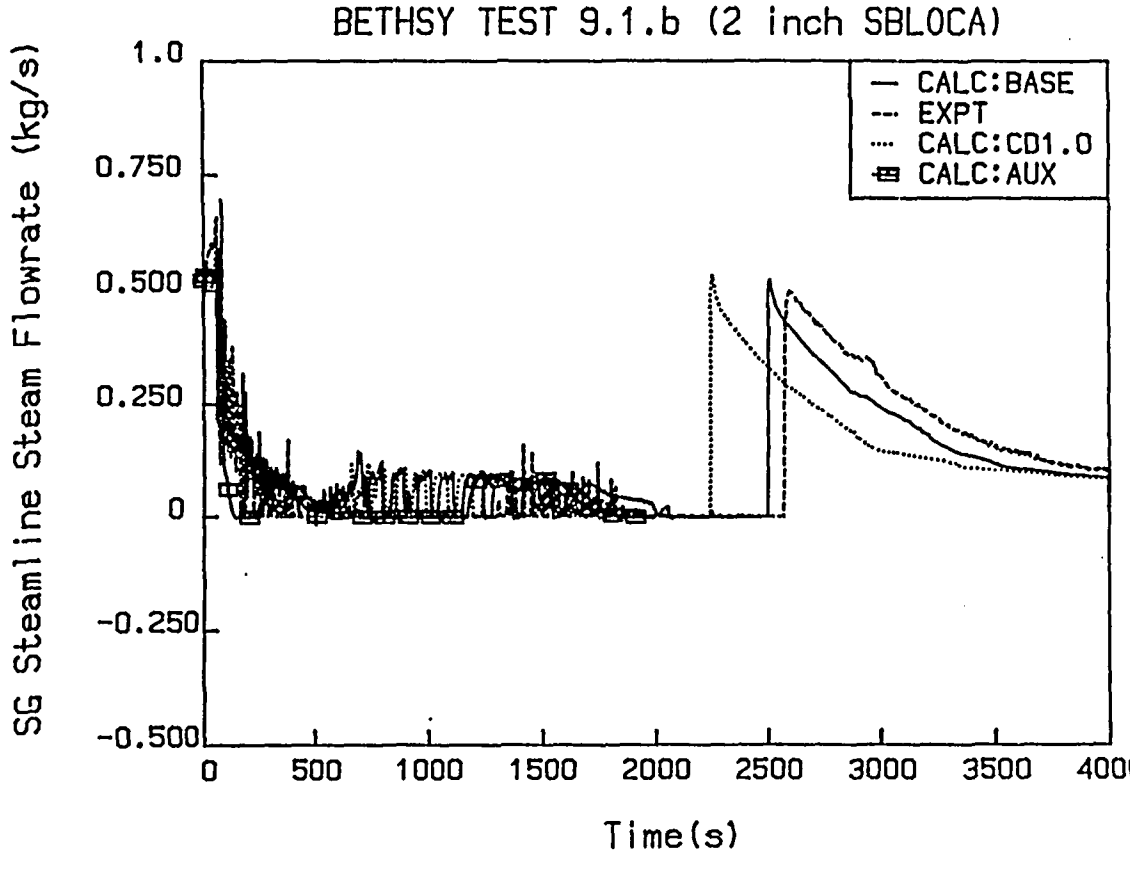

Fig. 74 SG Steamline Steam Flowrate

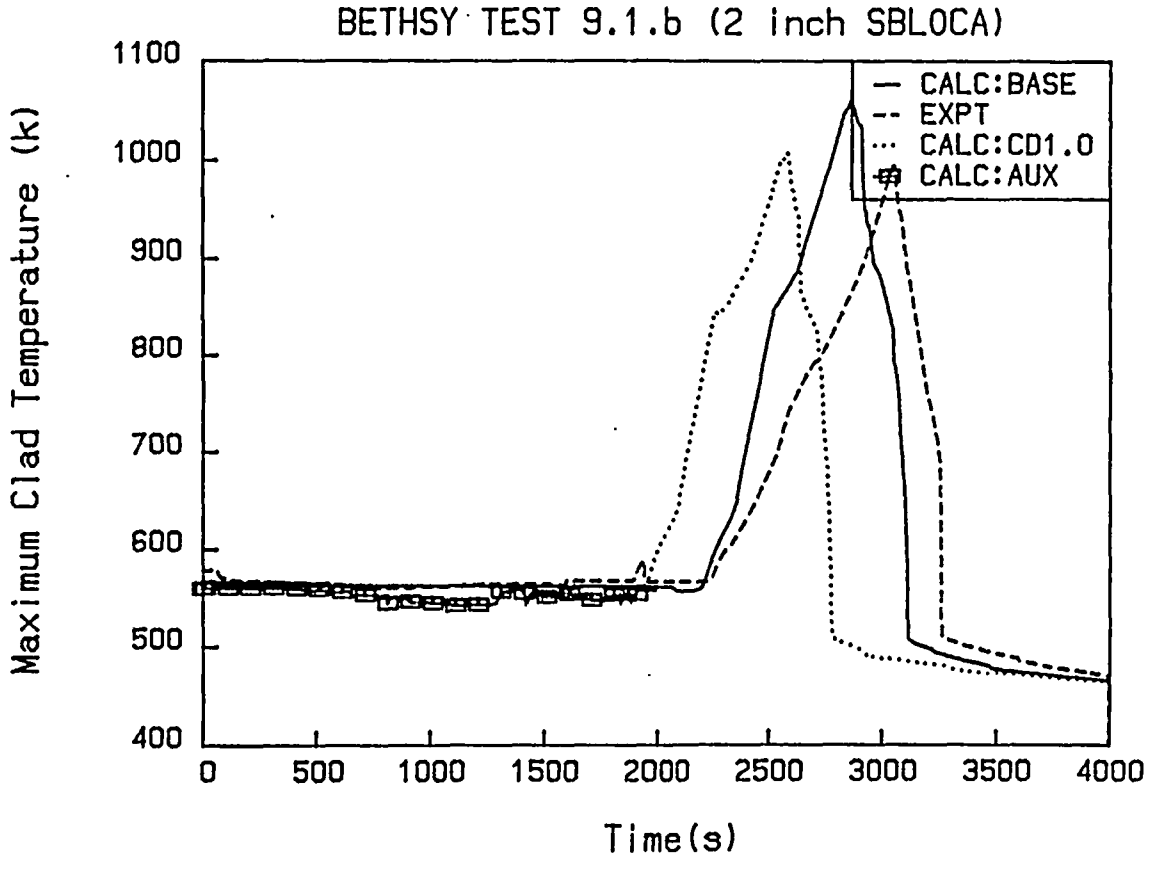

Fig. 75 Maximum Clad Temperaturte

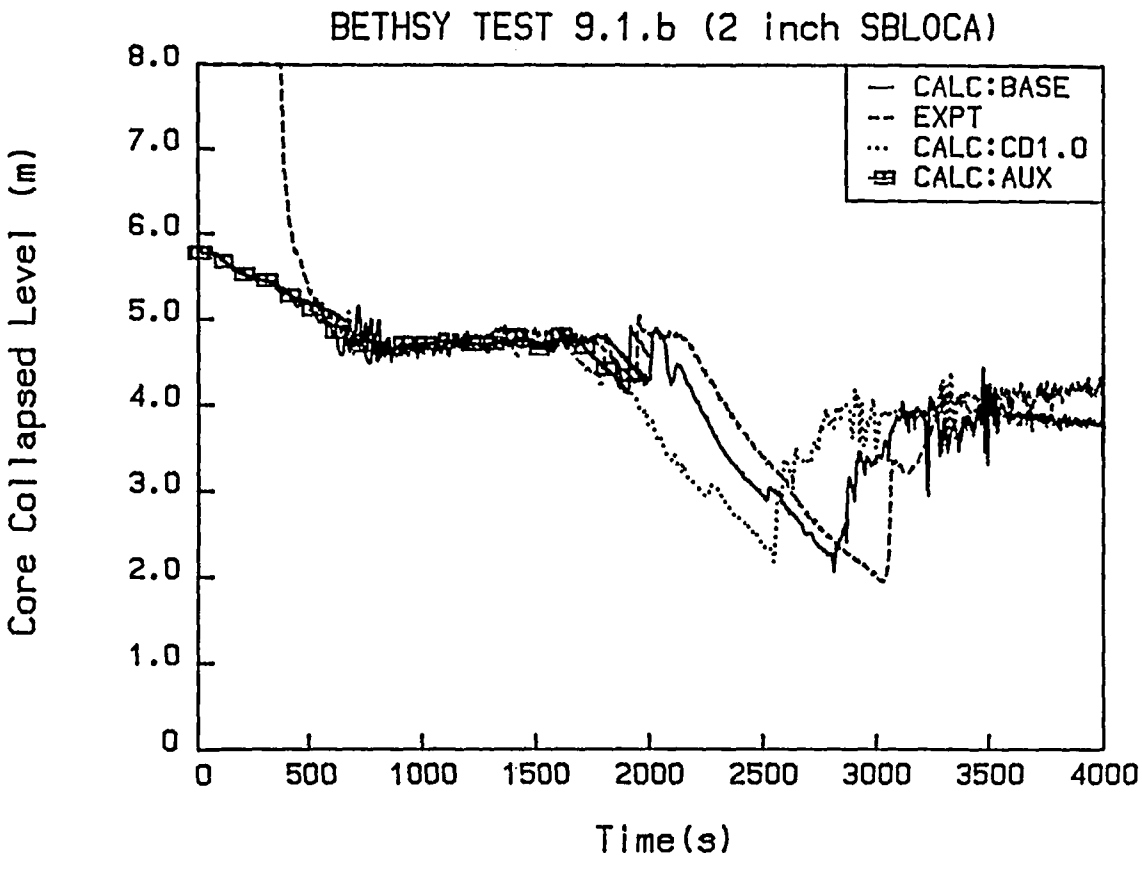

Fig. 76 Core Collapsed Level

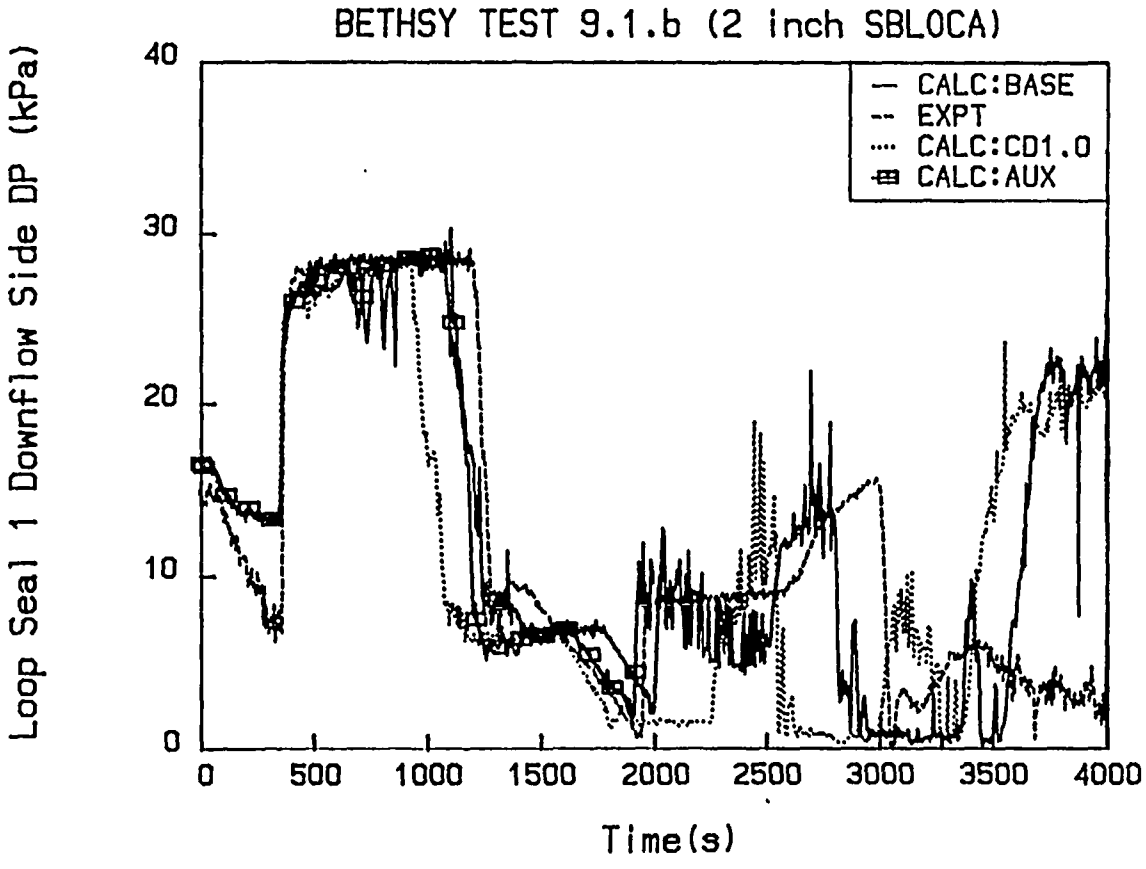

Fig. 77 Loop Seal 1 Downflow Side Diff. Pressure

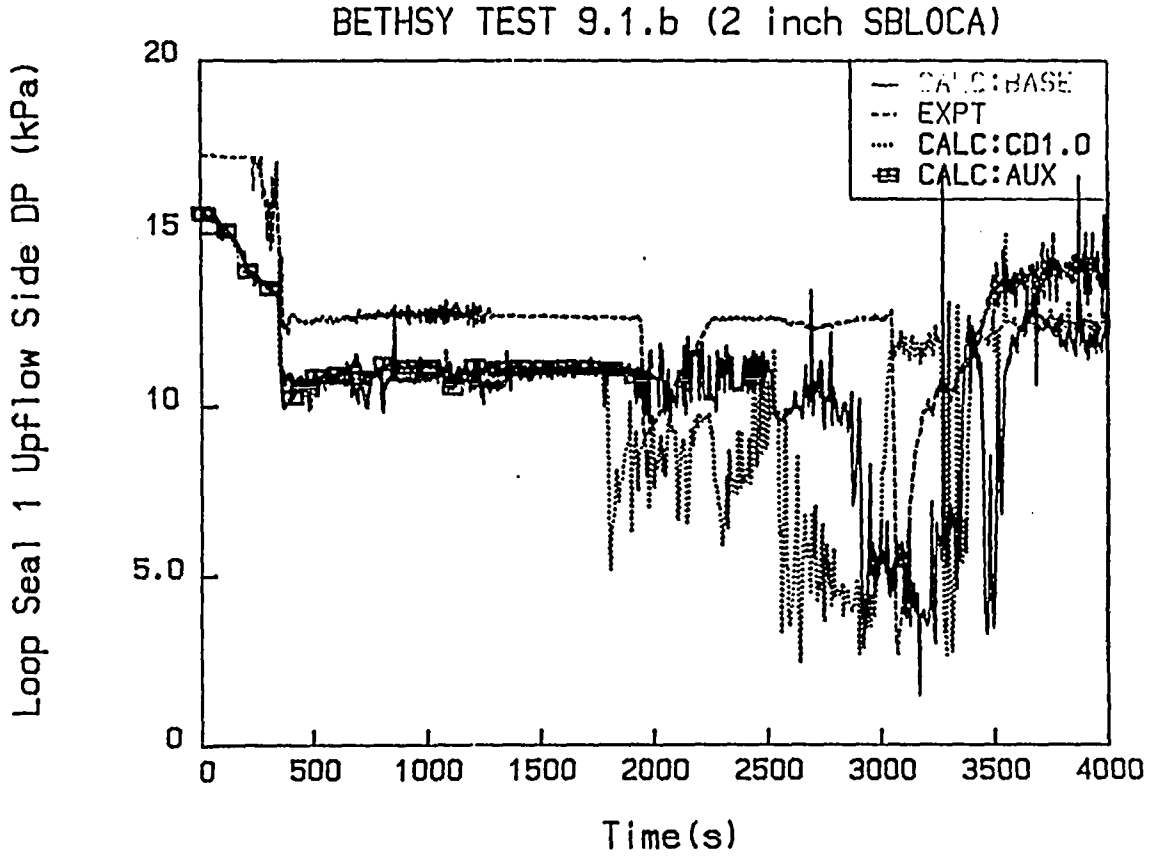

Fig. 78 Loop Seal 1 Upflow Side Diff. Pressure

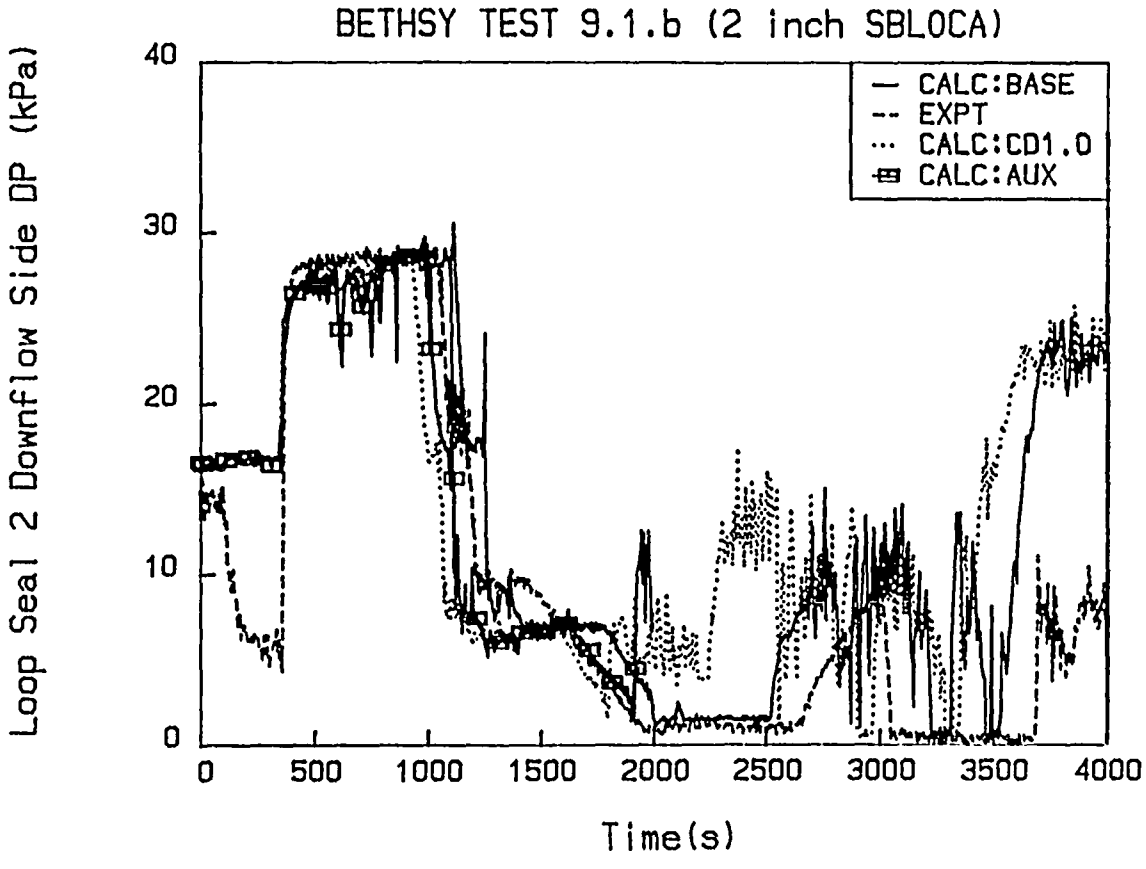

Fig. 79 Loop Seal 2 Downflow Side Diff. Pressure

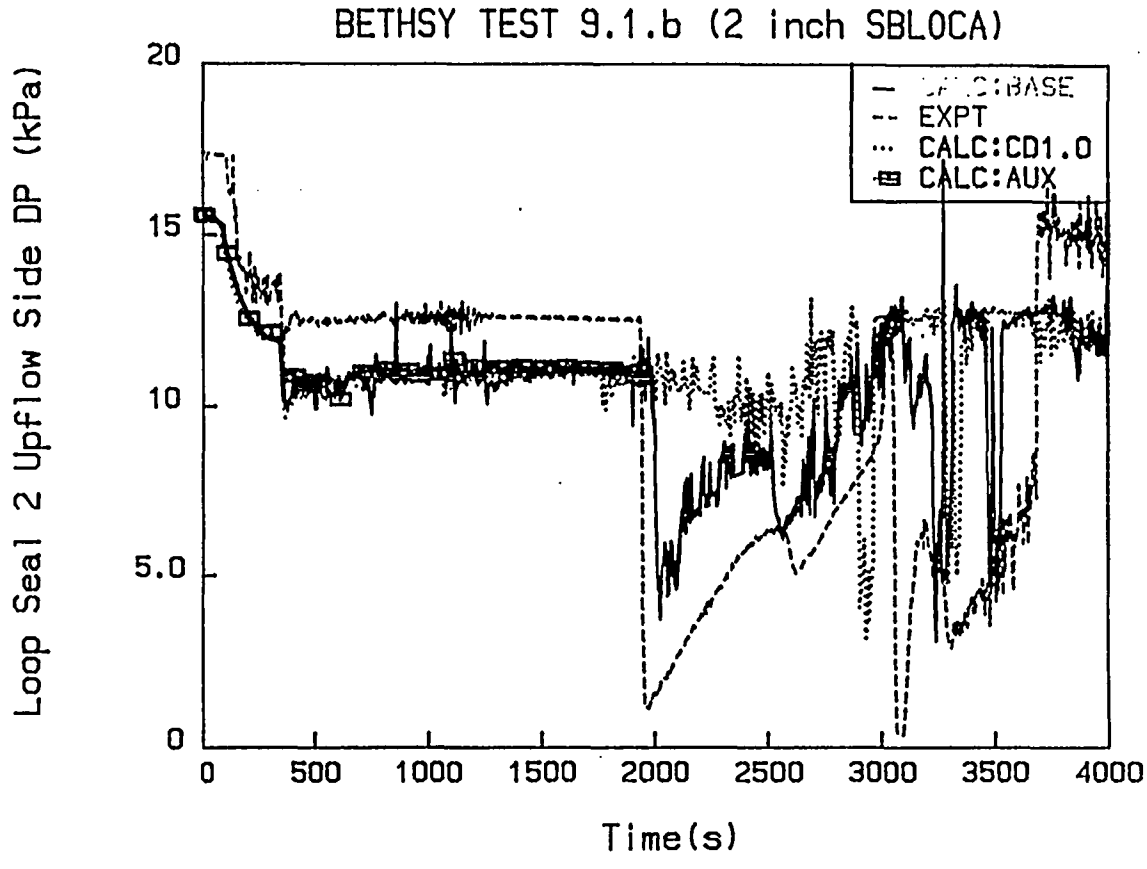

Fig. 80 Loop Seal 2 Upflow Side Diff. Pressure

Appendix

```
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*   This contains a RELAP5 model of the French experimental facility      *
*   BETHSY.  The intended use of the model is for simulation of BETHSY    *
*   test 9.1.b which studies the 2 inch cold leg break without hpsi       *
*   and with delayed ultimate procedure.                                  *
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
= 2 inch cold leg break : bethsy test 9.1.b
*
100    new    stdy-st
101    run
102    si   si
105    2.       4.
*
110     nitrogen
115     1.0
*
120     13010000    0.0    water    primary
121     60010000    7.1057 water    secndry
122     70010000    7.1057 water    seclopb
123     80010000    7.1057 water    seclopc
*
201     500.0  1.e-6   0.05    3  20  2000  2000
*
****************************************************
*  minor edit variables
****************************************************
*
301   p          091050000
302   p          068010000
303   p          078010000
304   p          088010000
305   p          034010000
306   p          034220000
307   p          044010000
308   p          044220000
309   p          054010000
310   p          054220000
314   tempf      031010000
315   tempf      039010000
316   tempf      041010000
317   tempf      049010000
318   tempf      051010000
319   tempf      059010000
323   mflowj     012010000
324   mflowj     099010000
325   mflowj     301000000
326   mflowj     401000000
```

```
327   mflowj   501000000
328   mflowj   039010000
329   mflowj   049010000
330   mflowj   059010000
331   mflowj   608000000
332   mflowj   708000000
333   mflowj   808000000
337   pmpvel   36
338   pmphead  36
339   cntrlvar 424
340   cntrlvar 425
341   cntrlvar 1
342   cntrlvar 4
343   cntrlvar 159
344   cntrlvar 199
345   cntrlvar 319
346   cntrlvar 2
347   cntrlvar 22
348   cntrlvar 330
349   mflowj   601000000
350   mflowj   606000000
351   cntrlvar   266
*
*************************************************************************
*     self initialization controller cards
*************************************************************************
*
140              0              3              3
143             606     266     706     276     806     286
145             601     263     701     273     801     283
*
*************************************************************************
*   trips
*************************************************************************
*
407  time  0  lt  null  0 99999. n  0.
507 time  0  lt   null   0   10000.0   1
*
*************************************************************************
*  hydradynamic components
*************************************************************************
*
*************************************************************************
*lower plenum components
*************************************************************************
*
*************************************************************************
*    component 11 - lower portion of lower plenum
```

```
*******************************************************************************
*
0110000   lowerpl   branch
0110001   2   0
0110101  0.0  1.00     0.15323     0.0 -90. -1.00   4.57e-5  0.039   00100
0110200   003   15745056. 559.8
0111101  022010000  011000000    0.0      0.0     0.0   01100
0112101  011000000  012000000    0.0      0.0     0.0   01100
0111110  .045       0.          1.           1.
0112110 .01587      0.          1.           1.
0111201   7.480417 7.590417  0.   *  10.43635
0112201   3.364479 3.4044795 0.    *  10.43636
*
*******************************************************************************
*    component 12 - upper portion of lower plenum
*******************************************************************************
*
0120000   upperlp   branch
0120001    2    0
0120101  0.0  1.054  0.0620907  0.0  90.  1.054  4.57e-5 0.01543  00100
0120200   003   15737400. 559.8
0121101  012010000  013000000   .0428    1.5       1.5   01100
0122101  012010000  014000000    0.0     13.5      13.5  01000
0121110     .01130      0.          1.          1.
0122110     .004        0.          1.          1.
0121201  4.161302 4.221302  0.   *  10.06651
0122201   1.41488  1.64488  0.   *  .3698466
*
*******************************************************************************
*core and core bypass components
*******************************************************************************
*
*******************************************************************************
*    component 13 - core
*******************************************************************************
*
0130000   core   pipe
0130001   7
0130101   0.0   1          *volume areas
0130102   0.0428  6
0130103   0.0   7
0130201   0.0   6          *junction areas
0130301   0.11  1          *volume length
0130302   0.788   2
0130303   0.78    3
0130304   0.52    4
0130305   0.78    5
0130306   0.788   6
```

```
0130307   0.35    7
0130401   0.004708  1     *volume volume
0130402   0.0       6
0130403   0.018066  7
0130601   90.0      7     *vert angle
0130701   .11       1     *delta z
0130702   .788      2
0130703   .78       3
0130704   .52       4
0130705   .78       5
0130706   .788      6
0130707   .35       7
0130801   4.57e-5  .01130  1   *roughness  diam
0130802   4.57e-5  .01130  6
0130803   4.57e-5  .06584  7
0130901    .31      .31    6   *junction loss coef
0131001    00100   7           *volume flags pvbfe
0131101    01000   6           *junction flags vcahs
0131201    003    15712976. 559.8   0.   0.         0. 1
0131202    003    15699616. 560.2   0.    0.        0. 2
0131203    003    15673800. 561.1   0.   0.        0. 3
0131204    003    15659048. 562.0   0.   0.        0. 4
0131205    003    15644392. 562.5   0.   0.         0. 5
0131206    003    15618848. 563.0   0.   0.        0. 6
0131207    003    15604872. 563.3   0.   0.        0. 7
0131300    0
0131301   4.161303 4.1913034 0.  1   *  10.06651
0131302   4.173902 4.1939024 0.  2   *  10.0665
0131303   4.189569 4.209569  0.  3   *  10.0665
0131304   4.194801 4.204801  0.  4   *  10.0665
0131305   4.201244 4.201244  0.  5   *  10.0665
0131306   4.214391 4.214391  0.  6   *  10.06651
0131401  .0113     0.        1.        1.    6
*
*******************************************************************************
* component 14 -  core bypass
*******************************************************************************
*
0140000   cbypass  pipe
0140001   7
0140101   1.421e-2   7         *volume areas
0140201   0.0   6          *junction areas
0140301   0.11  1          *volume length
0140302   0.788   2
0140303   0.78    3
0140304   0.52    4
0140305   0.78    5
0140306   0.788   6
```

```
0140307   0.35     7
0140401   0.0      7      *volume volume
0140601   90.0     7      *vert angle
0140701   .11      1      *delta z
0140702   .788     2
0140703   .78      3
0140704   .52      4
0140705   .78      5
0140706   .788     6
0140707   .35      7
0140801   4.57e-5  .0247   7   *roughness  diam
0140901    1.072   1.072   6   *junction loss coef
0140901    16.0    16.0    6   *junction loss coef
0141001    00000   7           *volume flags pvbfe
0141101    01000   6           *junction flags vcahs
0141201    003    15723096. 559.8   0.0   0.        0. 1
0141202    003    15709768. 560.1   0.0   0.        0. 2
0141203    003    15683984. 560.5   0.0   0.        0. 3
0141204    003    15669224. 561.0   0.0   0.         0. 4
0141205    003    15654520. 561.5   0.0   0.         0. 5
0141206    003    15638920. 562.0   0.   0.        0. 6
0141207    003    15614888. 562.5   0.0   0.         0. 7
0141300    0
0141301    1.4149   1.4038   0. 1  *  .3698466
0141302    1.41042  1.41076  0. 2  *  .369632
0141303    1.41723  1.44268  0. 3  *  .369634
0141304    1.41531  1.47611  0. 4  *  .369634
0141305    1.41644  1.40702  0. 5  *  .3696346
0141306    0.50139  0.590595 0. 6  *  .369635
0141401       .0247     0.     1.    1.   6
*************************************************************************
*upper plenum components
*************************************************************************
*
*************************************************************************
*    component 99 upper plenum 1
*************************************************************************
*
0990000   upplen1  branch
0990001   4    0
0990101  0.0  0.5525  5.0302e-2  0.0  90.  0.5525 4.57e-5 .2380 00000
0990200  003    15600120. 563.
0991101  014010000  099000000    0.0    13.5   13.5  01000
0992101  013010000  099000000    0.0     1.5    1.5  01100
0993101  099010000  015000000    0.0     0.0    0.0  01000
0994101  099010000  017000000    0.0     0.92   .998 01000
0991201  1.41158  1.585256  0.  *  .3696344
0992201  3.49723  3.54723   0.   *  10.06651
```

```
0993201  2.344489 2.559943  0.  *  10.18996
0994201  1.582433    1.582433     0.  *  .246178
0991110    .004       0.     1.   1.
0992110    .238       0.     1.   1.
0993110    .2081      0.     1.   1.
0994110    .0603      0.     1.   1.
*
*******************************************************************************
*    component 15 upper plenum 2
*******************************************************************************
*
0150000   upplen2  branch
0150001   4    0
0150101  0.0  1.051  .091564    0.0  90.  1.051  4.57e-5 .182  00000
0150200  003    15596200. 563.3
0151101  015010000  016000000  0.08706   0.0   0.0   01000
0152101  015010000  031000000  0.010936  .46   .834  01002
0153101  015010000  041000000  0.010936  .46   .834  01002
0154101  015010000  051000000  0.010936  .46   .834  01002
0151201   -0.8027-4   -0.10387-4  0.  *  -.002072645
0152201  6.171221 6.541802  0.  *  3.39708
0153201  6.261221 6.641802  0.  *  3.39708
0154201  6.261221 6.641802  0.  *  3.39708
0151110    .2081      0.     1.   1.
0152110    .118       0.     1.   1.
0153110    .118       0.     1.   1.
0154110    .118       0.     1.   1.
*
*******************************************************************************
*    component 16 - flow area from upper plenum to upper head
*******************************************************************************
*
0160000   upplen2    snglvol
0160101   0.0   2.206     .11263   0.0   90.0   2.206   4.57e-5  .129  000000
0160200   003   15586312. 563.0
*******************************************************************************
*    component 17 - guide tubes
*******************************************************************************
*
0170000   gtubes    snglvol
0170101    .00 3.257  9.0671e-3  0.0  90.  3.257 4.57e-5 .0603 00000
0170200   003   15586824.   563.0
*
*******************************************************************************
*    component 18 - upper head
*******************************************************************************
*
0180000   uphead   branch
```

```
0180001  3      0
0180101  0.0 0.4475 4.9072e-2 0.0  90.0  0.4475 4.57e-5 0.0 00000
0180200   003   15595592.   563.0
0181101  016010000  018000000  7.0686e-6  0.0   0.0     01100
0182101  017010000  018000000  7.063e-4   0.92  .998    01000
0183101  018000000  019000000   0.0       0.0   0.0     01100
0181201    -5.4422-4   -5.5422-4   0.  *  -.00201577
0182201   -6.05085     -6.05085     0.  *  .246176
0183201  -0.0639743 -0.0763554   0.  *  .2439847
0181110   .003    0.    1.   1.
0182110   .0203   0.    1.   1.
0183110   .170    0.    1.   1.
*
*******************************************************************************
*    component 19 - upper head to downcomer bypass
*******************************************************************************
*
0190000   dcbypas   snglvol
0190101   0.0   1.37786  8.9259e-2   0.0  -90. -1.37786  4.57e-5 .135  00000
0190200   003    15591856.   560.0
*
*******************************************************************************
*    component 200 - junction to downcomer bypass
*******************************************************************************
*
2000000    dcbyjun   sngljun
2000101    019010000   021000000 2.454e-4    1.15  1.15    01000
2000201   0  -17.3342    -44.0342     0.  *  .243605
2000110   6.25e-3  0.    1.   1.
*
*******************************************************************************
*    component 21 - downcomer bypass
*******************************************************************************
*
0210000   dcbypas   pipe
0210001   3                *nvol
0210101   0.0   3          *volume area
0210201   0.0   2          *jun area
0210301    1.7614    1     *volume length
0210302    1.142635  2
0210303    0.2095    3
0210401    3.7831e-3 1     *volume volume
0210402    2.4414e-3 2
0210403    0.9697e-3 3
0210601    -18.2     1     *vert angle
0210602    -21.6     2
0210603    -90.0     3
0210701  -.55049     1     *delta z
```

```
0210702  -.42005     2
0210703  -.2095      3
0210801   4.57e-5  0.0   3 *roughness  diam
0210901   0.1     0.1   1 *junction  f-loss   r-loss
0210902   0.0     0.0   2
0211001   00000  3          *volume flags
0211101   01000  2        *junction vcahs
0211201   003   15730808. 560.0   0.0   0.        0. 1
0211202   003   15741144. 560.0   0.0   0.        0. 2
0211203   003   15743320. 560.0   0.0   0.        0. 3
0211300   0
0211301  -2.023346   -2.023346    0. 1 *  .24359
0211302  -2.02334    -2.02334     0. 2 *  .2435797
0211401   .0492    0.    1.   1.  2
*
*******************************************************************************
*    component 20 - downcomer inlet
*******************************************************************************
*
0200000   dcinlet   branch
0200001    5   0
0200101   0.0  0.927  .0433233  0.0  -90. -0.927  4.57e-5 0.0   00000
0200200   003   15757472.    560.
0201101   021010000  020000000  0.0         0.0   0.0   01100
0202101   039010000  020000000  1.0936e-2   .834  .46   01001
0203101   049010000  020000000  1.0936e-2   .834  .46   01001
0204101   059010000  020000000  1.0936e-2   .834  .46   01001
0205101   020010000  022000000  0.0         0.10  0.10  01100
0201201  -0.93435 -0.934447    0.  *  .243576
0202201  6.510582 6.810582  0.  *  3.397646
0203201  6.510582 6.810582  0.  *  3.397646
0204201  6.510582 6.810582  0.  *  3.397646
0205201  8.442823 8.862246  0.  *  10.43632
0201110   0.0      0.    1.   1.
0202110   .118     0.    1.   1.
0203110   .118     0.    1.   1.
0204110   .118     0.    1.   1.
0205110   .1731    0.    1.   1.
*
*******************************************************************************
*    component 22 - downcomer
*******************************************************************************
*
0220000    dcomer   pipe
0220001    7             *=nvol
0220101     0.0      7    *volume area
0220201     0.0      6    *junction area
0220301   1.011625   4    *volume length
```

```
0220302   .31919     5
0220303   .4602      6
0220304   1.054      7
0220401   23.9771e-3 4     *volume volumes
0220402    7.5115e-3 5
0220403   10.8295e-3 6
0220404   27.9758e-3 7
0220601    -90.0   4      *vertical angles
0220602    -55.8   5
0220603    -46.0   6
0220604    -90.0   7
0220701  -1.011625 4      *delta z
0220702   -.26396  5
0220703   -.33003  6
0220704   -0.85412 7
0220801    4.57e-5   .1731    6  *roughness  diam
0220802    4.57e-5   4.5e-2   7
0220901   0.0   0.0   3 *junction f-loss r-loss
0220902   .054  .054  4 *junction f-loss r-loss
0220903   .017  .017  5 *junction f-loss r-loss
0220904   .285  .285  6 *junction f-loss r-loss
0221001    00000  7       *volume  flags
0221101    01000  6       *junction vcahs
0221201    003    15720472.  560.0   0.0   0.        0. 1
0221202    003    15725952.  560.0   0.0   0.        0. 2
0221203    003    15730440.  560.0   0.0   0.       0. 3
0221204    003    15735920.  560.0   0.0   0.        0. 4
0221205    003    15737624.  560.0   0.0   0.       0. 5
0221206    003    15738816.  560.0   0.0   0.        0. 6
0221207    003    15735168.  560.0   0.0   0.        0. 7
0221300   0
0221301  8.382818 8.764339  0.  1 *  10.43633
0221302  8.382813 8.764312  0.  2 *  10.43633
0221303  8.382808 8.764285  0.  3 *  10.43633
0221304  8.436977 8.768767  0.  4 *  10.43634
0221305  8.436996 8.758048  0.  5 *  10.43634
0221306  8.436994 8.786994  0.  6 *  10.43635
0221401   .1731     0.    1.   1.  5
0221402   4.5e-2    0.    1.   1.  6
*
**********************************************************************
*        primary loop piping components single loop-a
**********************************************************************
*
**********************************************************************
*    component 31 - single loop (loop a) hot leg
**********************************************************************
*
```

```
0310000  hotlga1   snglvol
0310101  1.0936e-2   1.1941  0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0310200   003   15576088.   563.3
*
*************************************************************************
*    component 32 - pressure surge line nozzle in single loop
*************************************************************************
*
0320000   hotlga2   branch
0320001   0    1
0320101  1.0936e-2  0.5    0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0320200  003   15576080.   563.3
*
*************************************************************************
*    component 33 - single loop hot leg to sg
*************************************************************************
*
0330000   hotlga3   pipe
0330001   3
0330101   1.0936e-2   3   *volume area
0330201   1.0936e-2   2   *junction area
0330301   0.79775     1   *volume length
0330302   1.44800     2
0330303   0.5506      3
0330401   0.0         3   *volume volumes
0330601   0.0         1   *vert angle
0330602   90.         2
0330603   50.         3
0330701   0.0         1   *delta z
0330702   1.44800     2
0330703   0.4637      3
0330801   4.57e-5  .118   3   *rough  diam
0330901   0.117   0.117   1  *junction  f-loss  r-loss
0330902   0.065   0.065   2  *junction  f-loss  r-loss
0331001   00000   3          * vol flags
0331101   01000  2         * vcahs
0331201   003   15636072. 563.3   0.0   0.        0. 1
0331202   003   15651056. 563.3   0.0   0.        0. 2
0331203   003   15654440. 563.3   0.0   0.        0. 3
0331300   0
0331301   6.28299  6.41299  0. 1  *  3.397625
0331302   6.26303  6.54904  0. 2  *  3.39762
0331401   .118     0.    1.   1.  2
*
*************************************************************************
*    component 301 - h.l. junction to pressurizer surge nozzle
*************************************************************************
*
```

```
3010000    hotlg4a   sngljun
3010101  031010000  032000000 0.0 0.0 0.0 01000
3010201  0   6.17222  6.25222  0.   *  3.39708
3010110   .118     0.    1.   1.
*
*******************************************************************************
*    component 302 - h.l. junction from pressurizer surge nozzle
*******************************************************************************
*
3020000    hotlg5a   sngljun
3020101  032010000  033000000 0.0 0.0 0.0 01000
3020201  0   6.262985 6.342985 0.  *  3.39763
3020110   .118     0.    1.   1.
*
*******************************************************************************
*    component 303 - junction from surge line to h.l. nozzle (tripvalve)
*******************************************************************************
*
3030000    prsurgj   sngljun
3030101   032010000  090000000  0.0  0.0    0.0    01000
3030201  0   -0.83763-4  -1.29763-4  0.  *  -5.45044-4
3030110   .0429    0.    1.   1.
*******************************************************************************
*    component 35 - single loop cold leg pump suction piping
*******************************************************************************
*
0350000 pumpsa   pipe
0350001         5
0350101  0.0          5    *volume areas
0350201  1.0936e-2    4    *junction areas
0350301  0.4189       1    *volume lengths
0350302  1.94015      2
0350303  2.22285      3
0350304  0.820        4
0350305  2.0697       5
0350401  4.5810e-3     1
0350402 21.2175e-3     2
0350403 24.3095e-3    3
0350404  8.9670e-3    4
0350405 22.6340e-3    5
0350601  -50.00       1    *vertical angle
0350602  -90.         3
0350603  0.0          4
0350604  90.          5
0350701  -.3404       1    *delta z
0350702  -1.94015     2
0350703  -2.12015     3
0350704    0.0        4
```

```
0350705   1.9671     5
0350801   4.57e-5  0.0   5 *volume roughnes diam
0350901   .065     .065     1 *f-loss  r-loss
0350902   0.0      0.0      2 *f-loss  r-loss
0350903   .117     .117     3
0350904   .117     .117     4
0351001   00000  5         * volume flags
0351101   01000  4         *junction vcahs
0351201   003   15284064. 560.0   0.0   0.          0. 1
0351202   003   15292512. 560.0   0.0   0.         0. 2
0351203   003   15307552. 560.0   0.0   0.          0. 3
0351204   003   15305400. 560.0   0.0   0.          0. 4
0351205   003   15298072. 560.0   0.0   0.          0. 5
0351300   0
0351301   6.20586  6.37195  0. 1 *  3.3976
0351302   6.20582  6.461855 0. 2 *  3.397604
0351303   6.20575  6.47146  0. 3 *  3.39761
0351304   6.205716 6.345716 0. 4 *  3.397614
0351401   .118     0.    1.   1.  4
*
*************************************************************************
*    component 37 - single loop pump discharge piping
*************************************************************************
*
0370000   cldlgal   pipe
0370001   2
0370101   1.0936e-2   2   *volume areas
0370201   1.0936e-2   1   *juntion areas
0370301   1.05        1   *volume lengths
0370302   0.859       2   *volume lengths
0370401   0.0         2   *volume volumes
0370501   0.0         2   *horiz angle
0370601   0.0         2   *vertical angle
0370701   0.0         2   *delta z
0370801   4.57e-5 0.0  2   *roughness  diam
0370901   0.0    0.0  1   *junction f-loss  r-loss
0371001    00    2         *volume fe
0371101  01000   1         *junction vcahs
0371201   003   15757504. 560.0   0.0   0.          0. 1
0371202   003   15757496. 560.0   0.0   0.          0. 2
0371300   0
0371301   6.185816 6.275816 0. 1 *  3.39763
0371401   .118     0.    1.   1.  1
*
*************************************************************************
*    component 38 - single loop accumulator nozzle
*************************************************************************
*
```

```
0380000   accnoza    branch
0380001   2   0
0380101   1.0936e-2   0.5     0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0380200   003   15757488.   560.0
0381101   037010000  038000000  1.0936e-2  0.0  0.0  01000
0382101   038010000  039000000  1.0936e-2  0.0  0.0  01000
0381201    6.18582  6.26582  0.    *  3.397636
0382201    6.18582  6.26582  0.    *  3.39764
0381110   .118     0.    1.   1.
0382110   .118     0.    1.   1.
*
*************************************************************************
*    component 39 - single loop cold leg piping
*************************************************************************
*
0390000   cldlga2   pipe
0390001   2
0390101   1.0936e-2    2 *volume areas
0390201   1.0936e-2    1 *junction areas
0390301   .78406        1 *volume lengths
0390302   .53586        2
0390401   0.0          2 *=volume volumes
0390601   0.0          2 *vertical angle
0390701   0.0          2 *delta z
0390801   4.57e-5  0.0   2 *roughness  diam
0390901   .144   .144   1 *junction f-loss  r-loss
0391001   00000 2         *volume flags
0391101   01000 1         *junction vcahs
0391201   003   15757480. 560.0   0.0   0.        0. 1
0391202   003   15747464. 560.0   0.0   0.       0. 2
0391300   0
0391301   6.17582  6.31582  0. 1 *  3.39764
0391401   .118     0.    1.   1.  1
*
*************************************************************************
*    component 36 - inlet portion of single loop pump
*************************************************************************
0360000  pumpa   pump
0360101 0.0   0.350   0.02062  0.0  41.518   0.232 00000
0360108  035010000   1.0936e-2  0.0  0.0  01000
0360109  037000000  1.0936e-2   0.0  0.0  01000
0360200  003   15534160. 560.0
0360201    0   6.20575  5.60145  0.   *  3.39762
0360202    0   6.23     6.51     0.   *  3.397625
0360110   .118     0.    1.   1.
0360111   .118     0.    1.   1.
*
0360301    0       0         0         -1      0      000       0
```

```
0360302  311. 0.9899  6.3056e-2   78.0  144.75  37.3  750.0  0.  0. 4.65e-2 0. 0
*
**************************************************
*      bethsy pump single phase homologous curves  *
**************************************************
*
*      han
0361100 1  1  0.0   1.3257 0.1   1.3317 0.2   1.3273 0.3   1.3135 0.4   1.2909
0361101       0.5   1.2603 0.6   1.2223 0.7   1.1780 0.75  1.1536 0.775 1.1409
0361102       0.8   1.1279 0.825 1.1146 0.85  1.1009 0.875 1.0870 0.9   1.0728
0361103       0.925 1.0583 0.95  1.0437 0.975 1.0287 0.987 1.0215 1.0   1.0135
*      ban
0361200 2  1  0.0   0.5139 0.1   0.5633 0.2   0.6128 0.3   0.6622 0.4   0.7116
0361201       0.5   0.7610 0.6   0.8105 0.7   0.8599 0.75  0.8846 0.775 0.8969
0361202       0.8   0.9093 0.825 0.9216 0.85  0.9340 0.875 0.9463 0.9   0.9587
0361203       0.925 0.9710 0.95  0.9834 0.975 0.9957 0.987 1.0017 1.0   1.0081
*      hvn
0361300 1  2  0.0  -0.5772 0.1  -0.4471 0.2  -0.3169 0.3  -0.1868 0.4  -0.0567
0361301       0.5   0.0733 0.6   0.2035 0.7   0.3572 0.75  0.4471 0.775 0.4951
0361302       0.8   0.5450 0.825 0.5969 0.85  0.6508 0.875 0.7066 0.9   0.7643
0361303       0.925 0.8238 0.95  0.8852 0.975 0.9485 0.987 0.9795 1.0   1.0135
*      bvn
0361400 2  2  0.0  -0.5772 0.1  -0.4145 0.2  -0.2518 0.3  -0.0891 0.4   0.0735
0361401       0.5   0.2362 0.6   0.3989 0.7   0.5616 0.75  0.6429 0.775 0.6836
0361402       0.8   0.7243 0.825 0.7579 0.85  0.7915 0.875 0.8263 0.9   0.8611
0361403       0.925 0.8972 0.95  0.9333 0.975 0.9707 0.987 0.9886 1.0   1.0081
*      had
0361500 1  3  -1.   1.3257  0.0  1.3257
*      bad
0361600 2  3  -1.   0.5139  0.0  0.5139
*      hvd
0361700 1  4  -1.0  1.3257 -.900 1.2801 -.800 1.2346 -.700 1.1889 -.600 1.1434
0361701       -.500 1.0978 -.400 1.0522 -.300 1.0067 -.275 0.9953 -.250 0.9839
0361702       -.225 0.9725 -.200 0.9611 -.175 0.9497 -.150 0.9383 -.125 0.9269
0361703       -.100 0.9156 -.075 0.9042 -.050 0.8928 -.025 0.8814  0.00 0.8700
*      bvd
0361800 2  4  -1.0  0.5139  0.00 0.5139
*      hat
0361900 1  5  0.0   1.3257  1.00 1.3257
*      bat
0362000 2  5  0.0   0.5139  1.00 0.5139
*      hvt
0362100 1  6  .0   0.8700  .025 0.8814 .050 0.8928 .075 0.9042 .100 0.9156
0362101       .125 0.9269  .150 0.9383 .175 0.9497 .200 0.9611 .225 0.9725
0362102       .250 0.9839  .275 0.9953 .300 1.0067 .400 1.0522 .500 1.0978
0362103       .600 1.1434  .700 1.1889 .800 1.2346 .900 1.2801 1.00 1.3257
*      bvt
0362200 2  6  0.0   0.5139  1.000 0.5139
```

```
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*
*   the following four curves were not provided in the bethsy data base
*   the values used were estimated from the relap5/mod2 manual examples
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*
*      har
0362300  1  7  -1.0  0.1     0.0  1.3257
*      bar
0362400  2  7  -1.0  -1.5    0.0  .5139
*      hvr
0362500  1  8  -1.0  0.1     0.0  -.5772
*      bvr
0362600  2  8  -1.0  -1.5    0.0  -.5772
*
*
0363000     0    0.0   0.0     0.1   0.0     0.2   0.0     0.3   0.50
0363001          0.4   1.00    0.6   1.0     0.7   1.0     0.8   1.00
0363002          0.9   1.00    1.0   0.0
0363100     0    0.0   0.0     0.1   0.0     0.2   0.0     0.3   0.50
0363101          0.4   1.00    0.6   1.0     0.7   1.0     0.8   1.00
0363102          0.9   1.00    1.0   0.0
*
*      two-phase difference tables from semiscale
*
0364100 1   1    0.0   0.00    0.1   0.83    0.2   1.09
0364101          0.5   1.02    0.6   1.015   0.7   1.01
0364102          0.9   0.94    1.0   1.00
0364200 1   2    0.0   0.00    0.1  -0.04    0.2   0.00    0.3   0.11
0364201          0.4   0.21    0.8   0.67    0.9   0.80    1.0   1.0
0364300 1   3   -1.0  -1.06   -0.9  -1.24   -0.8  -1.77
0364301         -0.7  -2.36   -0.6  -2.79   -0.5  -2.91   -0.4  -2.67
0364302         -0.25 -1.69   -0.1  -0.50    0.0   0.00
0364400 1   4   -1.0  -1.16   -0.9  -0.78   -0.8  -0.05
0364401         -0.7  -0.31   -0.6  -0.17   -0.5  -0.17
0364402         -0.35  0.00   -0.2   0.05    0.0   0.11
0364500 1   5    0.0   0.00    0.2  -0.34
0364501          0.4  -0.65    0.6  -0.95
0364502          0.8  -1.19    1.0  -1.47
0364600 1   6    0.0   0.11    0.1   0.13    0.25  0.15
0364601          0.4   0.13    0.5   0.07    0.6  -0.04    0.7  -0.23
0364602          0.8  -0.51    0.9  -0.91    1.0  -1.47
0364700 1   7    0.0   0.0     1.0   0.0
0364800 1   8    0.0   0.0     1.0   0.0
0364900 2   1    0.0   0.0     1.0   0.0
0365000 2   2    0.0   0.0     1.0   0.0
```

```
0365100 2   3   0.0   0.0     1.0   0.0
0365200 2   4   0.0   0.0     1.0   0.0
0365300 2   5   0.0   0.0     1.0   0.0
0365400 2   6   0.0   0.0     1.0   0.0
0365500 2   7   0.0   0.0     1.0   0.0
0365600 2   8   0.0   0.0     1.0   0.0
*
*****************************************************************
* pump speed controller for steady calculation
*****************************************************************
*
0366100     0     cntrlvar,425
0366101     0.0     0.0
0366102     2400.0     2400.0
*
*
20542400     mserr     sum     1.0  0.0  1
20542401     51.1   -1.0   mflowj,301000000
20542500     rcpspp integral 0.1  311.   0
20542501     cntrlvar,424
*
*****************************************************************************
*  primary loop piping components -single loop b
*****************************************************************************
*
*****************************************************************************
*    component 41 - single loop (loop b) hot leg
*****************************************************************************
*
0410000   hotlgb1   snglvol
0410101  1.0936e-2   1.1941  0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0410200   003   15576088.  563.3
*
*****************************************************************************
*    component 42 -  single loop
*****************************************************************************
*
0420000   hotlgb2   snglvol
0420101  1.0936e-2  0.5    0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0420200  003   15576080.  563.3
*
*****************************************************************************
*    component 43 - single loop hot leg to sg
*****************************************************************************
*
0430000   hotlgb3   pipe
0430001   3
0430101   1.0936e-2   3   *volume area
```

```
0430201   1.0936e-2   2   *junction area
0430301   0.79775     1   *volume length
0430302   1.44800     2
0430303   0.5506      3
0430401   0.0         3   *volume volumes
0430601   0.0         1   *vert angle
0430602   90.         2
0430603   50.         3
0430701   0.0         1   *delta z
0430702   1.44800     2
0430703   0.4637      3
0430801   4.57e-5  .118   3   *rough  diam
0430901   0.117   0.117   1  *junction  f-loss  r-loss
0430902   0.065   0.065   2  *junction  f-loss  r-loss
0431001   00000   3          * vol flags
0431101   01000  2         * vcahs
0431201   003   15560072. 563.3   0.0   0.        0. 1
0431202   003   15565056. 563.3   0.0   0.        0. 2
0431203   003   15565440. 563.3   0.0   0.        0. 3
0431300   0
0431301   6.26299  6.41299  0. 1  *  3.397625
0431302   6.26303  6.56904  0. 2  *  3.39762
0431401   .118     0.    1.   1.  2
*
*******************************************************************************
*    component 401 - h.1. junction to hot leg
*******************************************************************************
*
4010000    hotlg4b   sngljun
4010101  041010000  042000000 0.0 0.0 0.0 01000
4010201  0  6.261222 6.331222  0.   *  3.39708
4010110   .118     0.    1.   1.
*
*******************************************************************************
*    component 402 - h.1. junction from pressurizer surge nozzle
*******************************************************************************
*
4020000    hotlg5b   sngljun
4020101  042010000  043000000 0.0 0.0 0.0 01000
4020201  0  6.261298 6.3412985 0.  *  3.39763
4020110   .118     0.    1.   1.
*
*******************************************************************************
*    component 45 - single loop cold leg pump suction piping
*******************************************************************************
*
0450000 pumpsa   pipe
0450001         5
```

```
0450101  0.0          5    *volume areas
0450201  1.0936e-2    4    *junction areas
0450301  0.4189       1    *volume lengths
0450302  1.94015      2
0450303  2.22285      3
0450304  0.820        4
0450305  2.0697       5
0450401  4.5810e-3     1
0450402 21.2175e-3     2
0450403 24.3095e-3    3
0450404  8.9670e-3    4
0450405 22.6340e-3    5
0450601  -50.00       1    *vertical angle
0450602  -90.         3
0450603  0.0          4
0450604  90.          5
0450701  -.3404       1    *delta z
0450702  -1.94015     2
0450703  -2.12015     3
0450704    0.0        4
0450705   1.9671      5
0450801   4.57e-5  0.0   5 *volume roughnes diam
0450901   .065     .065     1 *f-loss  r-loss
0450902   0.0      0.0      2 *f-loss  r-loss
0450903   .117     .117     3
0450904   .117     .117     4
0451001   00000  5          * volume flags
0451101   01000  4          *junction vcahs
0451201   003   15284064. 560.0   0.0   0.          0. 1
0451202   003   15292512. 560.0   0.0   0.         0. 2
0451203   003   15307552. 560.0   0.0   0.          0. 3
0451204   003   15305400. 560.0   0.0   0.          0. 4
0451205   003   15298072. 560.0   0.0   0.          0. 5
0451300  0
0451301  6.210586 6.350195  0. 1 *  3.3976
0451302  6.210582 6.4701855 0. 2 *  3.397604
0451303  6.210575 6.470146  0. 3 *  3.39761
0451304  6.210571 6.3705716 0. 4 *  3.397614
0451401   .118     0.    1.   1.  4
*
*************************************************************************
*    component 47 - single loop pump discharge piping
*************************************************************************
*
0470000   cldlgal   pipe
0470001   2
0470101   1.0936e-2   2   *volume areas
0470201   1.0936e-2   1   *juntion areas
```

```
0470301   1.05          1   *volume lengths
0470302   0.859         2   *volume lengths
0470401   0.0           2   *volume volumes
0470501   0.0           2   *horiz angle
0470601   0.0           2   *vertical angle
0470701   0.0           2   *delta z
0470801   4.57e-5 0.0   2   *roughness  diam
0470901   0.0    0.0   1   *junction f-loss  r-loss
0471001    00    2         *volume fe
0471101  01000   1         *junction vcahs
0471201   003   15757504. 560.0   0.0   0.          0. 1
0471202   003   15757496. 560.0   0.0   0.          0. 2
0471300   0
0471301  6.190581 6.2805816 0. 1 *  3.39763
0471401   .118     0.    1.   1.  1
*
*************************************************************************
*    component 48 - single loop accumulator nozzle
*************************************************************************
*
0480000   accnoza    branch
0480001   2   0
0480101   1.0936e-2   0.5     0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0480200   003   15757488.  560.0
0481101   047010000  048000000  1.0936e-2  0.0  0.0  01000
0482101   048010000  049000000  1.0936e-2  0.0  0.0  01000
0481201   6.180582 6.270582  0.   *  3.397636
0482201   6.180582 6.270582  0.   *  3.39764
0481110   .118     0.    1.   1.
0482110   .118     0.    1.   1.
*
*************************************************************************
*    component 49 - single loop cold leg piping
*************************************************************************
*
0490000   cldlga2   pipe
0490001   2
0490101   1.0936e-2    2 *volume areas
0490201   1.0936e-2    1 *junction areas
0490301   .78406        1 *volume lengths
0490302   .53586        2
0490401   0.0          2 *=volume volumes
0490601   0.0          2 *vertical angle
0490701   0.0          2 *delta z
0490801   4.57e-5  0.0   2 *roughness  diam
0490901   .144   .144   1 *junction f-loss  r-loss
0491001   00000 2         *volume flags
0491101   01000 1         *junction vcahs
```

```
0491201   003   15757480. 560.0   0.0   0.          0. 1
0491202   003   15747464. 560.0   0.0   0.         0. 2
0491300   0
0491301  6.180582 6.320582  0. 1 *  3.39764
0491401   .118     0.    1.   1.  1
*
*******************************************************************
*    component 46 - inlet portion of single loop pump
*******************************************************************
0460000  pumpb   pump
0460101 0.0   0.350  0.02062   0.0  41.518 0.232  00000
0460108  045010000   1.0936e-2  0.0  0.0  01000
0460109  047000000   1.0936e-2  0.0  0.0  01000
0460200  003   15534160. 560.0
0460201    0  6.200575 6.360145  0.   *  3.39762
0460202    0  6.23      6.51     0.   *  3.397625
0460110   .118     0.    1.   1.
0460111   .118     0.    1.   1.
*
0460301   36       36       36         -1      36      000       0
*
0460302  311. 0.9899  6.3056e-2   78.0  144.75  37.3  750.0  0.  0. 4.65e-2 0. 0
*
*******************************************************************
*  primary loop piping components - single loop c
*******************************************************************
*
*******************************************************************
*    component 51 - single loop (loop c) hot leg
*******************************************************************
*
0510000   hotlgc1   snglvol
0510101  1.0936e-2   1.1941  0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0510200   003   15576088.   563.3
*
*******************************************************************
*    component 52 - pressure surge line nozzle in single loop
*******************************************************************
*
0520000   hotlgc2   snglvol
0520101  1.0936e-2  0.5    0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0520200  003   15576080.  563.3
*
*******************************************************************
*    component 53 - single loop hot leg to sg
*******************************************************************
*
0530000   hotlgc3   pipe
```

```
0530001   3
0530101   1.0936e-2   3   *volume area
0530201   1.0936e-2   2   *junction area
0530301   0.79775     1   *volume length
0530302   1.44800     2
0530303   0.5506      3
0530401   0.0         3   *volume volumes
0530601   0.0         1   *vert angle
0530602   90.         2
0530603   50.         3
0530701   0.0         1   *delta z
0530702   1.44800     2
0530703   0.4637      3
0530801   4.57e-5  .118   3   *rough  diam
0530901   0.117   0.117   1  *junction  f-loss  r-loss
0530902   0.065   0.065   2  *junction  f-loss  r-loss
0531001   00000   3          * vol flags
0531101   01000  2         * vcahs
0531201   003    15560072. 563.3   0.0   0.        0. 1
0531202   003    15565056. 563.3   0.0   0.        0. 2
0531203   003    15565440. 563.3   0.0   0.        0. 3
0531300   0
0531301  6.261299 6.411299  0. 1  *  3.397625
0531302  6.261303 6.561904  0. 2  *  3.39762
0531401   .118     0.    1.   1.  2
*
*******************************************************************************
*    component 501 - h.1. junction to pressurizer surge nozzle
*******************************************************************************
*
5010000    hotlg4c   sngljun
5010101  051010000  052000000 0.0 0.0 0.0 01000
5010201  0  6.261222 6.331222  0.   *  3.39708
5010110   .118     0.    1.   1.
*
*******************************************************************************
*    component 502 - h.1. junction from pressurizer surge nozzle
*******************************************************************************
*
5020000    hotlg5c   sngljun
5020101  052010000  053000000 0.0 0.0 0.0 01000
5020201  0  6.261298 6.3312985 0.  *  3.39763
5020110   .118     0.    1.   1.
*
*******************************************************************************
*    component 55 - single loop cold leg pump suction piping
*******************************************************************************
*
```

```
0550000 pumpsc   pipe
0550001         5
0550101  0.0          5    *volume areas
0550201  1.0936e-2    4    *junction areas
0550301  0.4189       1    *volume lengths
0550302  1.94015      2
0550303  2.22285      3
0550304  0.820        4
0550305  2.0697       5
0550401  4.5810e-3     1
0550402 21.2175e-3     2
0550403 24.3095e-3    3
0550404  8.9670e-3    4
0550405 22.6340e-3    5
0550601  -50.00       1    *vertical angle
0550602  -90.         3
0550603  0.0          4
0550604  90.          5
0550701  -.3404       1    *delta z
0550702  -1.94015     2
0550703  -2.12015     3
0550704    0.0        4
0550705   1.9671      5
0550801   4.57e-5  0.0   5 *volume roughnes diam
0550901   .065     .065     1 *f-loss  r-loss
0550902   0.0      0.0      2 *f-loss  r-loss
0550903   .117     .117     3
0550904   .117     .117     4
0551001   00000  5         * volume flags
0551101   01000  4         *junction vcahs
0551201   003   15284064. 560.0   0.0   0.          0. 1
0551202   003   15292512. 560.0   0.0   0.         0. 2
0551203   003   15307552. 560.0   0.0   0.          0. 3
0551204   003   15305400. 560.0   0.0   0.          0. 4
0551205   003   15298072. 560.0   0.0   0.          0. 5
0551300   0
0551301  6.200586 6.370195  0. 1 *  3.3976
0551302  6.200582 6.4701855 0. 2 *  3.397604
0551303  6.200575 6.470146  0. 3 *  3.39761
0551304  6.200571 6.3505716 0. 4 *  3.397614
0551401   .118     0.    1.   1.  4
*
*************************************************************************
*    component 57 - single loop pump discharge piping
*************************************************************************
*
0570000   cldlgal   pipe
0570001   2
```

```
0570101   1.0936e-2   2   *volume areas
0570201   1.0936e-2   1   *juntion areas
0570301   1.05        1   *volume lengths
0570302   0.859       2   *volume lengths
0570401   0.0         2   *volume volumes
0570501   0.0         2   *horiz angle
0570601   0.0         2   *vertical angle
0570701   0.0         2   *delta z
0570801   4.57e-5 0.0  2   *roughness  diam
0570901   0.0    0.0  1   *junction f-loss  r-loss
0571001    00    2        *volume fe
0571101  01000   1        *junction vcahs
0571201   003   15757504. 560.0   0.0   0.         0. 1
0571202   003   15757496. 560.0   0.0   0.         0. 2
0571300   0
0571301  6.190581 6.2805816 0. 1 *  3.39763
0571401   .118     0.    1.   1.  1
*
*************************************************************************
*    component 58 - single loop accumulator nozzle
*************************************************************************
*
0580000   accnozc    branch
0580001   2   0
0580101   1.0936e-2   0.5     0.0  0.0  0.0  0.0  4.57e-5 .118 00000
0580200   003   15757488.     560.0
0581101   057010000  058000000  1.0936e-2  0.0  0.0  01000
0582101   058010000  059000000  1.0936e-2  0.0  0.0  01000
0581201   6.180582 6.270582  0.   *  3.397636
0582201   6.180582 6.270582  0.   *  3.39764
0581110   .118     0.    1.   1.
0582110   .118     0.    1.   1.
* .
*************************************************************************
*    component 59 - single loop cold leg piping
*************************************************************************
*
0590000   cldlgc2   pipe
0590001   2
0590101   1.0936e-2    2 *volume areas
0590201   1.0936e-2    1 *junction areas
0590301   .78406        1 *volume lengths
0590302   .53586        2
0590401   0.0          2 *=volume volumes
0590601   0.0          2 *vertical angle
0590701   0.0          2 *delta z
0590801   4.57e-5  0.0   2 *roughness  diam
0590901   .144   .144   1 *junction f-loss  r-loss
```

```
0591001   00000 2          *volume flags
0591101   01000 1          *junction vcahs
0591201   003   15757480. 560.0   0.0   0.        0. 1
0591202   003   15747464. 560.0   0.0   0.        0. 2
0591300   0
0591301  6.180582 6.320582  0. 1 *  3.39764
0591401   .118     0.    1.   1.  1
*
*************************************************************************
*    component 56 - inlet portion of broken loop pump
*************************************************************************
0560000  pumpc   pump
0560101 0.0   0.35   0.02062  0.0  41.518  0.232  00000
0560108  055010000   1.0936e-2  0.0  0.0  01000
0560109  057000000   1.0936e-2  0.0  0.0  01000
0560200  003   15534160.  560.0
0560201    0  6.200559 6.360128  0.  *  3.39762
0560202    0  6.23      6.51      0.  * 3.39762
0560110   .118     0.    1.   1.
0560111   .118     0.    1.   1.
*
0560301   36      36        36         -1      36      000       0
*
0560302  311. 0.9899  6.3056-2   78.0 144.75  37.3  750.0  0. 0. 4.65e-2 0. 0.
*
*************************************************************************
*
*     description of primary system steam generator components
*
*************************************************************************
*     single loop a : broken loop
*************************************************************************
*
0340000   stmgena   pipe
0340001     22
0340101  0.0        1
0340102  1.0342e-2  21
0340103  0.0        22
0340201  1.0342e-2  21
0340301  0.798      1
0340302  0.2        2
0340303  0.4        3
0340304  0.6        4
0340305  0.8        5
0340306  1.0        6
0340307  1.5        10
0340308  0.725      12
0340309  1.5        16
```

```
0340310  1.0          17
0340311  0.8          18
0340312  0.6          19
0340313  0.4          20
0340314  0.2          21
0340315 -0.798        22
0340401  35.0607e-3   1
0340402  0.0          21
0340403  35.0607e-3   22
0340601  90.          11
0340602  -90.         22
0340701  0.7523       1
0340702  0.2          2
0340703  0.4          3
0340704  0.6          4
0340705  0.8          5
0340706  1.0          6
0340707  1.5          10
0340708  0.685        11
0340709 -0.685        12
0340710 -1.5          16
0340711 -1.0          17
0340712 -0.8          18
0340713 -0.6          19
0340714 -0.4          20
0340715 -0.2          21
0340716 -0.7523       22
0340801  4.57e-5   .229   1
0340802  1.0e-6    1.968e-2 21
0340803  4.57e-5   .229   22
0340901  .182      .530   1
0340901  0.0       0.0    1
0340902  0.0       0.0    10
0340903  .078      .078   11
0340903  0.0       0.0    11
0340904  0.0       0.0    20
0340905  .530      .182   21
0340905  0.0       0.0    21
0341001  00        22
0341101  11000     1    *ccfl on
0341102  01000     20   *ccfl off for j's 2-20
0341103  11000     21   *ccfl on
0341201  0         15510264. 1274710. 2443832. 0.        0. 1
0341202  0         15496888. 1265522. 2443912. 0.        0. 2
0341203  0         15484768. 1249498. 2443962. 0.        0. 3
0341204  0         15471200. 1229853. 2444046. 0.        0. 4
0341205  0         15456160. 1209553. 2444166. 0.        0. 5
0341206  0         15449608. 1290901. 2444320. 0.        0. 6
```

```
0341207  0        15440416. 1272667. 2444538. 0.        0. 7
0341208  0        15429320. 1260562. 2444800. 0.        0. 8
0341209  0        15318176. 1252372. 2445062. 0.        0. 9
0341210  0        15307000. 1246720. 2445328. 0.        0. 10
0341211  0        15398832. 1244427. 2445520. 0.        0. 11
0341212  0        15398768. 1242560. 2445522. 0.        0. 12
0341213  0        15306760. 1240036. 2445332. 0.        0. 13
0341214  0        15317744. 1238388. 2445072. 0.        0. 14
0341215  0        15328736. 1237328. 2444812. 0.        0. 15
0341216  0        15239736. 1236668. 2444554. 0.        0. 16
0341217  0        15248904. 1236374. 2444336. 0.        0. 17
0341218  0        15255504. 1236190. 2444180. 0.        0. 18
0341219  0        15260640. 1236035. 2444060. 0.        0. 19
0341220  0        15264304. 1235918. 2443974. 0.        0. 20
0341221  0        15266504. 1235825. 2443922. 0.        0. 21
0341222  0        15270096. 1235824. 2443836. 0.        0. 22
0341300  0
0341301  6.06659  6.06659  0.  1   *  3.397596
0341302  6.04233  6.04233  0.  2   *  3.397594
0341303  6.00105  6.00105  0.  3   *  3.39759
0341304  6.051265 6.051265 0.  4   *  3.39759
0341305  6.002835 6.002835 0.  5   *  3.39759
0341306  6.05996  6.05996  0.  6   *  3.397585
0341307  6.01923  6.01923  0.  7   *  3.39758
0341308  6.09331  6.09331  0.  8   *  3.39758
0341309  6.07625  6.07625  0.  9   *  3.39758
0341310  6.06467  6.06467  0.  10  *  3.39758
0341311  6.0599   6.0599   0.  11  *  3.39758
0341312  6.05599  6.05599  0.  12  *  3.39758
0341313  6.0507   6.0507   0.  13  *  3.397585
0341314  6.04723  6.04723  0.  14  *  3.397585
0341315  6.04499  6.04499  0.  15  *  3.39759
0341316  6.04358  6.04358  0.  16  *  3.39759
0341317  6.04293  6.04293  0.  17  *  3.39759
0341318  6.04252  6.04252  0.  18  *  3.39759
0341319  6.042175 6.042175 0.  19  *  3.39759
0341320  6.041915 6.041915 0.  20  *  3.39759
0341321  6.04171  6.04171  0.  21  *  3.39759
0341401  1.968e-2   0.    1.   0.725  1   *ccfl on
0341402  1.968e-2   0.    1.   1.     20  *ccfl off for j's 2-20
0341403  1.968e-2   0.    1.   0.725  21  *ccfl on
*
*******************************************************************************
* steamgenerator inlet junction
*******************************************************************************
*
3040000  sgina  sngljun
3040101  033010000  034000000 1.0936e-2  0.0  0.0  01100
```

```
3040201  0   6.26308  6.41928  0.  *  3.397615
3040110   .118     0.    1.   1.
*
*******************************************************************************
*   steam generator outlet junction
*******************************************************************************
*
3050000  sgouta  sngljun
3050101  034010000  035000000 1.093578e-2  0.0  0.0  01100
3050201  0   6.20596  6.40623  0.  *  3.3976
3050110   .118     0.    1.   1.
*
*******************************************************************************
*     single loop b
*******************************************************************************
*
0440000   stmgenb   pipe
0440001     22
0440101  0.0         1
0440102  1.0342e-2  21
0440103  0.0         22
0440201  1.0342e-2  21
0440301  0.798       1
0440302  0.2         2
0440303  0.4         3
0440304  0.6         4
0440305  0.8         5
0440306  1.0         6
0440307  1.5         10
0440308  0.725       12
0440309  1.5         16
0440310  1.0         17
0440311  0.8         18
0440312  0.6         19
0440313  0.4         20
0440314  0.2         21
0440315  0.798       22
0440401  35.0607e-3  1
0440402  0.0         21
0440403  35.0607e-3  22
0440601  90.         11
0440602  -90.        22
0440701  0.7523      1
0440702  0.2         2
0440703  0.4         3
0440704  0.6         4
0440705  0.8         5
0440706  1.0         6
```

```
0440707  1.5          10
0440708  0.685        11
0440709 -0.685        12
0440710 -1.5          16
0440711 -1.0          17
0440712 -0.8          18
0440713 -0.6          19
0440714 -0.4          20
0440715 -0.2          21
0440716 -0.7523       22
0440801  4.57e-5  .229  1
0440802  1.0e-6   1.968e-2 21
0440803  4.57e-5  .229  22
0440901  .182     .530  1
0440901  0.0      0.0   1
0440902  0.0      0.0   10
0440903  .078     .078  11
0440903  0.0      0.0   11
0440904  0.0      0.0   20
0440905  .530     .182  21
0440905  0.0      0.0   21
0441001  00       22
0441101  11000    1   *ccfl on
0441102  01000   20   *ccfl off for j's 2-20
0441103  11000   21   *ccfl on
0441201  0        15510264. 1274710. 2443832. 0.        0. 1
0441202  0        15496888. 1265522. 2443912. 0.        0. 2
0441203  0        15484768. 1249498. 2443962. 0.        0. 3
0441204  0        15471200. 1229853. 2444046. 0.        0. 4
0441205  0        15466160. 1209553. 2444166. 0.        0. 5
0441206  0        15449608. 1290901. 2444320. 0.        0. 6
0441207  0        15440416. 1272667. 2444538. 0.         0. 7
0441208  0        15429320. 1260562. 2444800. 0.         0. 8
0441209  0        15318176. 1252372. 2445062. 0.        0. 9
0441210  0        1.5307+7  1246720. 2445328. 0.         0. 10
0441211  0        15398832. 1244427. 2445520. 0.        0. 11
0441212  0        15398768. 1242560. 2445522. 0.         0. 12
0441213  0        15306760. 1240036. 2445332. 0.         0. 13
0441214  0        15317744. 1238388. 2445072. 0.        0. 14
0441215  0        15328736. 1237328. 2444812. 0.         0. 15
0441216  0        15299736. 1236668. 2444554. 0.        0. 16
0441217  0        15288904. 1236374. 2444336. 0.         0. 17
0441218  0        15275504. 1236190. 2444180. 0.        0. 18
0441219  0        15260640. 1236035. 2444060. 0.         0. 19
0441220  0        15264304. 1235918. 2443974. 0.        0. 20
0441221  0        15266504. 1235825. 2443922. 0.         0. 21
0441222  0        15270096. 1235824. 2443836. 0.         0. 22
0441300  0
```

```
0441301  6.06659  6.06659  0.  1   *  3.397596
0441302  6.04233  6.04233  0.  2   *  3.397594
0441303  6.00105  6.00105  0.  3   *  3.39759
0441304  6.051265 6.051265 0.  4   *  3.39759
0441305  6.002835 6.002835 0.  5   *  3.39759
0441306  6.05996  6.05996  0.  6   *  3.397585
0441307  6.01923  6.01923  0.  7   *  3.39758
0441308  6.09331  6.09331  0.  8   *  3.39758
0441309  6.07625  6.07625  0.  9   *  3.39758
0441310  6.06467  6.06467  0.  10  *  3.39758
0441311  6.0599   6.0599   0.  11  *  3.39758
0441312  6.05599  6.05599  0.  12  *  3.39758
0441313  6.0507   6.0507   0.  13  *  3.397585
0441314  6.04723  6.04723  0.  14  *  3.397585
0441315  6.04499  6.04499  0.  15  *  3.39759
0441316  6.04358  6.04358  0.  16  *  3.39759
0441317  6.04293  6.04293  0.  17  *  3.39759
0441318  6.04252  6.04252  0.  18  *  3.39759
0441319  6.042175 6.042175 0.  19  *  3.39759
0441320  6.041915 6.041915 0.  20  *  3.39759
0441321  6.04171  6.04171  0.  21  *  3.39759
0441401  1.968e-2   0.    1.   0.725  1   *ccfl on
0441402  1.968e-2   0.    1.   1.     20  *ccfl off for j's 2-20
0441403  1.968e-2   0.    1.   0.725  21  *ccfl on
*
*******************************************************************************
* steam generator inlet  junction
*******************************************************************************
*
4040000  sginb  sngljun
4040101  043010000  044000000 1.0936e-2  0.0  0.0  01100
4040201  0   6.26308  6.40928  0.  *  3.397615
4040110   .118     0.    1.   1.
*
*******************************************************************************
*   steam generator outlet junction
*******************************************************************************
*
4050000  sgoutb  sngljun
4050101  044010000  045000000 1.093578e-2  0.0  0.0  01100
4050201  0   6.20596  6.40623  0.  *  3.3976
4050110   .118     0.    1.   1.
*
*******************************************************************************
*    single loop -c
*******************************************************************************
*
0540000   stmgenc   pipe
```

```
0540001     22
0540101  0.0          1
0540102  1.0342e-2   21
0540103  0.0          22
0540201  1.0342e-2   21
0540301  0.798        1
0540302  0.2          2
0540303  0.4          3
0540304  0.6          4
0540305  0.8          5
0540306  1.0          6
0540307  1.5          10
0540308  0.725        12
0540309  1.5          16
0540310  1.0          17
0540311  0.8          18
0540312  0.6          19
0540313  0.4          20
0540314  0.2          21
0540315  0.798        22
0540401  35.0607e-3   1
0540402  0.0          21
0540403  35.0607e-3   22
0540601  90.          11
0540602  -90.         22
0540701  0.7523       1
0540702  0.2          2
0540703  0.4          3
0540704  0.6          4
0540705  0.8          5
0540706  1.0          6
0540707  1.5          10
0540708  0.685        11
0540709 -0.685        12
0540710 -1.5          16
0540711 -1.0          17
0540712 -0.8          18
0540713 -0.6          19
0540714 -0.4          20
0540715 -0.2          21
0540716 -0.7523       22
0540801  4.57e-5   .229   1
0540802  1.0e-6    1.968e-2 21
0540803  4.57e-5   .229   22
0540901  .182      .530   1
0540901  0.0       0.0    1
0540902  0.0       0.0    10
0540903  .078      .078   11
```

```
0540903  0.0      0.0   11
0540904  0.0      0.0   20
0540905  .530     .182  21
0540905  0.0      0.0   21
0541001  00       22
0541101  11000    1    *ccfl on
0541102  01000   20    *ccfl off for j's 2-20
0541103  11000   21    *ccfl on
0541201  0        15514264. 1274710. 2443832. 0.        0. 1
0541202  0        15496888. 1265522. 2443912. 0.        0. 2
0541203  0        15484768. 1249498. 2443962. 0.        0. 3
0541204  0        15471200. 1229853. 2444046. 0.        0. 4
0541205  0        15456160. 1209553. 2444166. 0.        0. 5
0541206  0        15449608. 1290901. 2444320. 0.        0. 6
0541207  0        15440416. 1272667. 2444538. 0.         0. 7
0541208  0        15329320. 1260562. 2444800. 0.         0. 8
0541209  0        15318176. 1252372. 2445062. 0.        0. 9
0541210  0        1.5307+7  1246720. 2445328. 0.         0. 10
0541211  0        15338832. 1244427. 2445520. 0.        0. 11
0541212  0        15338768. 1242560. 2445522. 0.         0. 12
0541213  0        15336760. 1240036. 2445332. 0.         0. 13
0541214  0        15337744. 1238388. 2445072. 0.        0. 14
0541215  0        15338736. 1237328. 2444812. 0.         0. 15
0541216  0        15239736. 1236668. 2444554. 0.        0. 16
0541217  0        15238904. 1236374. 2444336. 0.         0. 17
0541218  0        15255504. 1236190. 2444180. 0.        0. 18
0541219  0        15260640. 1236035. 2444060. 0.         0. 19
0541220  0        15264304. 1235918. 2443974. 0.        0. 20
0541221  0        15266504. 1235825. 2443922. 0.         0. 21
0541222  0        15670096. 1235824. 2443836. 0.         0. 22
0541300  0
0541301  6.06659  6.06659  0.  1   *  3.397596
0541302  6.04233  6.04233  0.  2   *  3.397594
0541303  6.00105  6.00105  0.  3   *  3.39759
0541304  6.051265 6.051265 0.  4   *  3.39759
0541305  6.002835 6.002835 0.  5   *  3.39759
0541306  6.05996  6.05996  0.  6   *  3.397585
0541307  6.01923  6.01923  0.  7   *  3.39758
0541308  6.09331  6.09331  0.  8   *  3.39758
0541309  6.07625  6.07625  0.  9   *  3.39758
0541310  6.06467  6.06467  0.  10  *  3.39758
0541311  6.0599   6.0599   0.  11  *  3.39758
0541312  6.05599  6.05599  0.  12  *  3.39758
0541313  6.0507   6.0507   0.  13  *  3.397585
0541314  6.04723  6.04723  0.  14  *  3.397585
0541315  6.04499  6.04499  0.  15  *  3.39759
0541316  6.04358  6.04358  0.  16  *  3.39759
0541317  6.04293  6.04293  0.  17  *  3.39759
```

```
0541318  6.04252  6.04252  0.  18  *  3.39759
0541319  6.042175 6.042175 0.  19  *  3.39759
0541320  6.041915 6.041915 0.  20  *  3.39759
0541321  6.04171  6.04171  0.  21  *  3.39759
0541401  1.968e-2   0.    1.   0.725  1   *ccfl on
0541402  1.968e-2   0.    1.   1.     20  *ccfl off-for j's 2-20
0541403  1.968e-2   0.    1.   0.725  21  *ccfl on
*
*******************************************************************************
* component 504 steam generator inlet junction
*******************************************************************************
*
5040000  sginc  sngljun
5040101  053010000  054000000 1.0936e-2  0.0  0.0  01100
5040201  0   6.26308  6.41928  0.  *  3.397615
5040110   .118     0.    1.   1.
*
*******************************************************************************
* component 505   steam generator outlet junction
*******************************************************************************
*
5050000  sgouta  sngljun
5050101  054010000  055000000 1.093578e-2  0.0  0.0  01100
5050201  0   6.20596  6.40623  0.  *  3.3976
5050110   .118     0.    1.   1.
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*
*              pressurizer and pressurizer surge line
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*******************************************************************************
*     component 90 pressurizer surge line
*******************************************************************************
0900000     prsurg     pipe
0900001     3
0900101     0.0        1  *volume areas
0900102   1.445e-3     2
0900103     0.0        3
0900201   1.445e-3     2  *junction areas
0900301   0.850        1  *volume lengths
0900302   0.0          2
0900303   2.69         3
0900401   1.11865e-3   1  *volume volumes
0900402   9.0406e-3    2
0900403   3.86375e-3   3
0900601   90.          1  *vertical angles
0900602   0.92         2
```

```
0900603   90.          3
0900701   0.850        1  *elevation changes
0900702   0.1          2
0900703   2.69         3
0900801   4.57e-5   0.0429  3         *roughness  diam
0900901   2.05     2.05    2         *junction loss coef
0901001   00          3   *volume fe
0901101   01000       2   *junction vcahs
0901201   003    15546480. 563.0   0.0   0.      0. 1
0901202   003    15544504. 563.0   0.0   0.        0. 2
0901203   003    15536800. 563.0   0.0   1.600417-5 0. 3
0901300   0
0901301   -5.88719-4  -5.8872-4   0.      1 *  -5.41856-4
0901302   -5.8603-4   .016745     0.      2 *  -5.38514-4
0901401   .0429    0.    1.   1.  2
*
**********************************************************************
*     component 91 - pressurizer
**********************************************************************
*
0910000     preszr    pipe
0910001     5
0910101     0.0     5  *volume areas
0910201     3.1276e-2  1  *junction areas
0910202     3.4636e-2  4
0910301     0.105      1  *volume lengths
0910302     0.892      2
0910303     5.4145     4
0910304     0.105      5
0910401     2.1616e-3  1  *volume volumes
0910402     2.7890e-2  2
0910403     0.187535   4
0910404     2.4245e-3  5
0910601     90.        5  *vertical angles
0910801     4.57e-5   0.210  5  *roughness  diam
0910901     0.0      0.0    4  *junction loss coef
0911001     00     5  *volume flags fe
0911101     01000  4  *junction flags vcahs
0911201     0      15528088. 1512193. 2.444+6  0.0   0. 1
0911202     0      15525984. 1512645. 2444076. 0.    0. 2
0911203     0      15518704. 1512336. 2452160. 0.5   0. 3
0911204     0      15512504. 1512835. 2452246. 1.0   0. 4
0911205     0      15510744. 1512734. 2452922. 1.0   0. 5
0911300     0
0911301     -2.700723-5 1.078118-4  0. 1 *  -5.36641-4
0911302     -5.00261-5  .612779    0. 2 *  -5.28403-4
0911303     -.406981    -3.83528-5  0. 3 *  -1.353289-4
0911304     -4.8759-7   -4.87571-7  0. 4 *  -1.717944-6
```

```
0911401   .210     0.    1.    1.  4
*
*********************************************************************
* component 93   trip valve for pzr steady  state
*********************************************************************
*
0930000      pzrvlv      valve
0930101     91010000      94000000   0.02    10.    10.    01100
0930201        1        0.0      0.0      0.0
0930300      trpvlv
0930301      507
*
*********************************************************************
* component 94  time dependent volume for pzr stp
*********************************************************************
*
0940000   pzr-tmdp    tmdpvol
0940101   0.   1.   100.   0.   90.   1.   0.   0.   11
0940200   002     0
0940201   0   15.51e6   1.0
*
************************************************************************
*    component 901 - pressurizer to surge line
************************************************************************
*
9010000   prtosur    sngljun
9010101  090010000   091000000  0.0  0.0  0.0   01100
9010201   0   -5.88604-4  .001109272  0.   *  -5.37312-4
9010110   .0429    0.    1.   1.
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*
*    steam generator secondary system components - single loop a
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
*
************************************************************************
*    component 60 - sg riser
************************************************************************
*
0600000  tubebun   pipe
0600001    10
0600101    0.0    10        *volume areas
0600201    0.0    9         *junction areas
0600301    0.2     1       *volume lengths
0600302    0.4     2       *volume lengths
0600303    0.6     3       *volume lengths
0600304    0.8     4       *volume lengths
```

```
0600305   1.0      5        *volume lengths
0600306   1.5      9        *volume lengths
0600307   1.8025   10       *volume lengths
0600401   0.01151  1         *volume volumes
0600402   0.02303  2         *volume volumes
0600403   0.03454  3         *volume volumes
0600404   0.04605  4         *volume volumes
0600405   0.05756  5         *volume volumes
0600406   0.08635  9         *volume volumes
0600407   0.10376  10        *volume volumes
0600601   90.      10        *vertiical angles
0600801   4.57e-5   0.03503  10  *roughness  diam
0600901   0.709   0.709  9   *junction resistance
0601001   00100      10     *flags pvbfe
0601101   01000      9      *flags vcahs
0601201   0     7028456. 1248771. 2582846. .042479   0.  1
0601202   0     7026396. 1249808. 2582862. .0791885  0.  2
0601203   0     7023096. 1250779. 2582890. .100384   0.  3
0601204   0     7018676. 1251212. 2582926. .1024675  0.  4
0601205   0     7013236. 1251169. 2582972. .1001885 0.   5
0601206   0     7016020. 1250842. 2583030. .137237   0.  6
0601207   0     7017640. 1250435. 2583100. .1617664 0.   7
0601208   0     6999476. 1250028. 2583166. .20956    0.  8
0601209   0     6991468. 1249626. 2583234. .253402   0.  9
0601210   0     6982900. 1249192. 2583306. .319663   0.  10
0601300   0
0601301   .291368    .293318   0. 1 *  8.3189
0601302   .296823    .3436065 0. 2 *  8.32017
0601303   .3058306   .414301   0. 3 *  8.32394
0601304   .318744    .485924    0. 4 *  8.32663
0601305   .335345    .542248   0. 5 *  8.32915
0601306   .3635625   .6048185   0. 6 *  8.33147
0601307   .4178196   .661324    0. 7 *  8.33338
0601308   .444346    .713936   0. 8 *  8.33501
0601309   .565791    .775627    0. 9 *  8.33651
0601401   .03503     0.        1.       1.    9
*
*************************************************************************
*    component 61 - lower steam dome
*************************************************************************
*
0610000   lstmdom   pipe
0610001   3
0610101   0.0         3   *volume area
0610201   0.0         2   *junction area
0610301   0.158       1   *volume length
0610302   0.7925      2
0610303   0.900       3
```

```
0610401   0.010393    1   *volume volumes
0610402   0.03861     2   *volume volumes
0610403   0.04385     3   *volume volumes
0610601   90.         3
0610801   4.57e-5  .249   3   *rough  diam
0610901   0.0     0.0     2  *junction  f-loss  r-loss
0611001   00000   3          * vol flags
0611101   01000   2        * vcahs
0611201   0       6977848. 1248987. 2583346.  .1070403 0. 1
0611202   0       6965112. 1248752. 2583374.  .124302  0. 2
0611203   0       6969880. 1248488. 2583418.  .1005756  0. 3
0611300   0
0611301    .426618    1.27186  0. 1  *  8.28098
0611302    .432377    1.227373 0. 2  *  8.30996
0611401   .249     0.    1.   1.  2
*
*******************************************************************
*    component 62 - middle steam dome and separator
*******************************************************************
*
0620000  mstmdom   branch
0620001    3    0
0620101  0.0   2.16    0.59549   0.0  90.  2.16   4.57e-5 .249   00
0620200  0       6953520. 1248202.   2583470. .64374
0621101  062010000  068000000  .502655    .816   .452   01000
0622101  062000000  063000000  44.915e-2  .060   .014   01002
0623101  061010000  062000000  4.8695e-2  0.0  0.0      01000
0621201   -0.49608    .04985623 0.  *  .283642
0622201   .3790846   2.01394252  0.  *  8.05382
0623201   .50494     2.84995    0.  *  8.2958
0621110   .800     0.    1.   1.
0622110   .539     0.    1.   1.
0623110   .249     0.    1.   1.
*
*******************************************************************
*    component 63 - upper downcomer
*******************************************************************
*
0630000  updwnc   snglvol
0630101    0.0    0.3375  .14922   0.0  -90.   -.3375   4.57e-5 .539  00
0630200  0      6953596.  1248164.   2583470. .594008
*
*******************************************************************
*    component 64 - upper feedwater ring
*******************************************************************
*
0640000   ufwring  snglvol
0640101  0.0    1.6055   0.15856   0.0  -90.  -1.6055  4.57e-5 0.176  00
```

```
0640200  0      6965196. 1248192.   2583464. .388591
*
*************************************************************************
*    component 65 - lower feedwater ring
*************************************************************************
*
0650000   lfwring   branch
0650001    2     0
0650101  0.0     .8275      .08172     0.0  -90.    -.8275  4.57e-5 .176  00
0650200  0        6970192. 1246853.    2583416. .022155
0651101  064010000  065000000     .09648       0.0   0.0     01000
0652101  065010000  066000000   3.0415e-2     .339  .459    01000
0651201    .2679376   .09100312  0.  *  8.05953
0652201    .651864  0.076746   0.  *  10.24751
0651110    .176    0.    1.   1.
0652110   .05983   0.    1.   1.
*
*************************************************************************
*    component 66 - 11 tube region
*************************************************************************
*
0660000   dc11tube  snglvol
0660101   0.0   1.9815  0.06336    0.0   -90.    -1.9815  4.57e-5 .05983 00
0660200  0        6988432. 1247671.    2583348. .071796
*
*************************************************************************
*    component 67 - sg-dc bottom part (4 tube region and bottom annulus)
*************************************************************************
*
0670000  dc4tube   pipe
0670001    9
0670101    0.0     9         *volume areas
0670201    0.0    8          *junction areas
0670301   1.481    1        *volume lengths
0670302   1.5      4        *volume lengths
0670303   1.0      5        *volume lengths
0670304   0.8      6        *volume lengths
0670305   0.6      7        *volume lengths
0670306   0.4      8        *volume lengths
0670307   0.2      9        *volume lengths
0670401  8.6429e-3  1        *volume volumes
0670402  8.7538e-3  4        *volume volumes
0670403  5.8359e-3  5        *volume volumes
0670404  4.6687e-3  6        *volume volumes
0670405  3.5015e-3  7        *volume volumes
0670406  2.3343e-3  8        *volume volumes
0670407  4.0563e-3  9        *volume volumes
0670601   -90.      9        *vertiical angles
```

```
0670801    4.57e-5   0.0431    9  *roughness  diam
0670901    0.0     0.0    7   *junction resistance
0670902    0.5     1.0    8   *junction resistance
0671001    00100       9    *flags pvbfe
0671101    01000       8    *flags vcahs
0671201    0      6986060. 1247739. 2583284. .0517344  0.  1
0671202    0      6995548. 1247816. 2583204. .0487328  0.  2
0671203    0      7005052. 1247899. 2583124. .0467894   0. 3
0671204    0      7004576. 1247988. 2583046. .0447651  0.  4
0671205    0      7012532. 1248050. 2582978. .0433005   0. 5
0671206    0      7018268. 1248102. 2582930. .0424226   0. 6
0671207    0      7022724. 1248145. 2582894. .0435893   0. 7
0671208    0      7025876. 1248196. 2582866. .0598894   0. 8
0671209    0      7028420. 1248220. 2582846. .02781746  0. 9
0671300    0
0671301    2.913655   1.79785    0. 1 *  8.31366
0671302    2.910042   1.791977   0. 2 *  8.30743
0671303    2.905814   1.799384   0. 3 *  8.30815
0671304    2.901764   1.793686   0. 4 *  8.30803
0671305    2.998793   1.79058    0. 5 *  8.30793
0671306    2.997078   1.7928     0. 6 *  8.30804
0671307    2.99953    1.7996     0. 7 *  8.3067
0671308    2.934037   1.79198    0. 8 *  8.31625
0671401    .0431      0.        1.       1.    8
*
*************************************************************************
*    component 609 - feedwater source
*************************************************************************
*
6090000   feedwtr  tmdpvol
6090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
6090200   103   0
6090201    0.0   6.910e6   491.1
*
*************************************************************************
*    component 68 - top of steam dome
*************************************************************************
*
0680000   tstmdom   snglvol
0680101   0.0   0.4       0.13404   0.0   90.   0.4    4.57e-5 .653   00
0680200  0       6952032. 1247984.   2583424. 1.
*
*************************************************************************
*    component 69 - steamline
*************************************************************************
*
0690000  stmline   pipe
0690001   2
```

```
0690101    0.0   2          *volume areas
0690201    0.0   1          *junction areas
0690301   15.825 2          *volume lengths
0690401   34.25e-3 2        *volume volumes
0690601   -90.  2           *vertical angles
0690701   -8.049  2         *delta z
0690801   4.57e-5  0.0525  2   *roughness  diam
0690901   2.888   2.888   1   *junction loss coef
0691001   00   2            * fe
0691101   01000  1           *vcahs
0691201   0     6941284. 1247946. 2583452. 1.      0. 1
0691202   0     6941772. 1247971. 2583498. 1.      0. 2
0691300   0
0691301   6.25976  6.49588  0. 1 *  .283683
0691401   .0525    0.    1.   1.  1
*
*************************************************************************
*   feedwater
*************************************************************************
*
*************************************************************************
*    component 601 - feedwater junction
*************************************************************************
*
 6010000              "fedwtr"            tmdpjun
 6010101   609000000     065000000     0.0
 6010200      1            0          cntrlvar        263     * feedctl
 *
 6010201  -1.0e+75          0.0            0.0             0.0
 6010202  -1.1e+10          0.0            0.0             0.0
 6010203  -1.0e+10       -1.0e+10          0.0             0.0
 6010204  -1.0e+9        -1.0e+9           0.0             0.0
 6010205  -1.0e+8         -1.0e+8           0.0             0.0
 6010206  -1.0e+7         -1.0e+7           0.0             0.0
 6010207  -1.0e+6         -1.0e+6           0.0             0.0
 6010208  -8.0e+5         -8.0e+5           0.0             0.0
 6010209  -6.0e+5         -6.0e+5           0.0             0.0
 6010210  -4.0e+5         -4.0e+5           0.0             0.0
 6010211  -2.0e+5         -2.0e+5           0.0             0.0
 6010212     0.0             0.0            0.0             0.0
 6010213   2.0e+5          2.0e+5           0.0             0.0
 6010214   4.0e+5          4.0e+5           0.0             0.0
 6010215   6.0e+5          6.0e+5           0.0             0.0
 6010216   8.0e+5          8.0e+5           0.0             0.0
 6010217   1.0e+6          1.0e+6           0.0             0.0
 6010218   1.0e+7          1.0e+7           0.0             0.0
 6010219   1.0e+8          1.0e+8           0.0             0.0
 6010220   1.0e+9          1.0e+9           0.0             0.0
```

```
 6010221   1.0e+10          1.0e+10          0.0              0.0
*
*******************************************************************
*    component 602 - junction between 11-tube and 4-tube regions
*******************************************************************
*
6020000   sgdwnc   sngljun
6020101   066010000  067000000 .005836  1.5   1.5   01000
6020201   0   3.3464   2.72928     0.  *  8.25925
6020110   .0431   0.    1.   1.
*
*******************************************************************
*    component 603 - downcomer to tube bundle
*******************************************************************
*
6030000   sgdcbot  sngljun
6030101  067010000  060000000 .025761 1.0   0.5    01000
6030201   0  .758816    .5368226   0.  *  8.30314
6030110   .02     0.    1.   1.
*
*******************************************************************
*    component 604 - steamdome to downcomer
*******************************************************************
*
6040000  sgdctop  sngljun
6040101  063010000  064000000 .09648  0.0   0.0    01000
6040201   0   6.98816    .01109985   0.  *  8.05694
6040110   .176    0.    1.   1.
*
*******************************************************************
*    component 605 - tube bundle to steam dome
*******************************************************************
*
6050000   ristodm   sngljun
6050101   060010000   061000000  .084496   0.0   0.0   01000
6050201   0   .1872706    .329899   0.  *  8.31636
6050110  0.328     0.   1.   1.
*
*******************************************************************
*    component 608 - top steam dome to steam line
*******************************************************************
*
6080000   tostmln  sngljun
6080101  068010000  069000000  .0011401     0.0   0.0   01100
6080201   0    6.396664 6.48532  0.  *  .2836816
6080110   .0381   0.    1.   1.
*
*******************************************************************
```

```
*    component 606 - steamline outlet
*******************************************************************
*
6060000             "trb st n"          valve
6060101   069010000    607000000    1.14e-3   0.0       0.0       00000
6060201    1               0.           .5234       0
6060300                  srvvlv
6060301      266              0  * steamctl...tcctl
6060401                   0.0          0.         0.0
6060402                   1.0      9357.2735      0.0  * this must be doubled
6060110     .0525    0.    1.   1.
*
*******************************************************************
*    component 607 - steamline sink volume
*******************************************************************
*
6070000   stmsink   tmdpvol
6070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
6070200   102   0
6070201   0.0   1.013e5   1.0
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*steam generator secondary system components - single loop b
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*******************************************************************
*    component 70 - sg riser
*******************************************************************
*
0700000  tubebun   pipe
0700001    10
0700101    0.0     10        *volume areas
0700201    0.0     9         *junction areas
0700301    0.2      1       *volume lengths
0700302    0.4      2       *volume lengths
0700303    0.6      3       *volume lengths
0700304    0.8      4       *volume lengths
0700305    1.0      5       *volume lengths
0700306    1.5      9       *volume lengths
0700307    1.8025  10       *volume lengths
0700401    0.01151  1        *volume volumes
0700402    0.02303  2        *volume volumes
0700403    0.03454  3        *volume volumes
0700404    0.04605  4        *volume volumes
0700405    0.05756  5        *volume volumes
0700406    0.08635  9        *volume volumes
```

```
0700407    0.10376  10       *volume volumes
0700601    90.      10       *vertiical angles
0700801    4.57e-5   0.03503  10  *roughness  diam
0700901    0.709   0.709  9    *junction resistance
0701001    00100      10     *flags pvbfe
0701101    01000      9      *flags vcahs
0701201    0      7028456. 1248771. 2582846. .042479   0.  1
0701202    0      7026396. 1249808. 2582862. .0791885  0.  2
0701203    0      7023096. 1250779. 2582890. .100384   0.  3
0701204    0      7018676. 1251212. 2582926. .1024675  0.  4
0701205    0      7013236. 1251169. 2582972. .1001885 0.   5
0701206    0      7016020. 1250842. 2583030. .137237   0.  6
0701207    0      7017640. 1250435. 2583100. .1617664 0.   7
0701208    0      6999476. 1250028. 2583166. .20956    0.   8
0701209    0      6991468. 1249626. 2583234. .253402   0.  9
0701210    0      6982900. 1249192. 2583306. .319663   0.  10
0701300    0
0701301    .291368     .253318    0. 1 *  8.3189
0701302    .2968235     .3436065 0. 2 *  8.32017
0701303    .3058306    .414301    0. 3 *  8.32394
0701304    .318744     .485924     0. 4 *  8.32663
0701305    .3353457     .542248    0. 5 *  8.32915
0701306    .3635625    .6048185    0. 6 *  8.33147
0701307    .3908196    .661324     0. 7 *  8.33338
0701308    .417346      .713936    0. 8 *  8.33501
0701309    .444791     .775627     0. 9 *  8.33651
0701401    .03503      0.         1.        1.    9
*
*************************************************************************
*    component 71 - lower steam dome
*************************************************************************
*
0710000   lstmdom   pipe
0710001   3
0710101   0.0          3   *volume area
0710201   0.0          2   *junction area
0710301   0.158        1   *volume length
0710302   0.7925       2
0710303   0.900        3
0710401   0.010393     1   *volume volumes
0710402   0.03861      2   *volume volumes
0710403   0.04385      3   *volume volumes
0710601   90.          3
0710801   4.57e-5  .249    3   *rough  diam
0710901   0.0      0.0     2  *junction  f-loss  r-loss
0711001   00000    3          * vol flags
0711101   01000  2          * vcahs
0711201   0      6977848. 1248987. 2583346.  .1070403 0. 1
```

```
0711202   0       6975112. 1248752. 2583374.  .124302  0. 2
0711203   0       6969880. 1248488. 2583418.  .1005756  0. 3
0711300   0
0711301    .426618    1.27186  0. 1  *  8.28098
0711302    .432377    1.227373 0. 2  *  8.30996
0711401   .249      0.    1.   1.  2
*
*******************************************************************
*    component 72 - middle steam dome and separator
*******************************************************************
*
0720000  mstmdom   branch
0720001    3    0
0720101  0.0   2.16    0.59549   0.0  90.  2.16   4.57e-5 .249   00
0720200  0       6953520. 1248202.   2583470. .64374
0721101  072010000  078000000  .502655    .816   .452   01000
0722101  072000000  073000000  44.915e-2  .060   .014   01002
0723101  071010000  072000000  4.8695e-2  0.0  0.0      01000
0721201   -0.49608   .04985623 0.  *  .283642
0722201   .3790846   2.01394252  0.  *  8.05382
0723201   .50494     2.04995    0.  *  8.2958
0721110   .800      0.    1.   1.
0722110   .539      0.    1.   1.
0723110   .249      0.    1.   1.
*
*******************************************************************
*    component 73 - upper downcomer
*******************************************************************
*
0730000  updwnc   snglvol
0730101    0.0    0.3375  .14922   0.0  -90.   -.3375   4.57e-5 .539  00
0730200  0      6953596.  1248164.   2583470. .594008
*
*******************************************************************
*    component 74 - upper feedwater ring
*******************************************************************
*
0740000   ufwring  snglvol
0740101  0.0    1.6055   0.15856   0.0  -90.  -1.6055  4.57e-5 0.176  00
0740200  0     6965196. 1248192.   2583464. .388591
*
*******************************************************************
*    component 75 - lower feedwater ring
*******************************************************************
*
0750000   lfwring   branch
0750001    2     0
0750101  0.0    .8275     .08172    0.0  -90.   -.8275  4.57e-5 .176  00
```

```
0750200  0       6970192. 1246853.   2583416. .022155
0751101  074010000  075000000    .09648      0.0   0.0    01000
0752101  075010000  076000000   3.0415e-2    .339  .459   01000
0751201    .2679376   .09100312  0.  *  8.05953
0752201    .651864  0.086746   0.  *  10.24751
0751110    .176    0.    1.   1.
0752110   .05983   0.    1.   1.
*
*******************************************************************
*    component 76 - 11 tube region
*******************************************************************
*
0760000   dc11tube  snglvol
0760101   0.0   1.9815  0.06336    0.0   -90.   -1.9815  4.57e-5 .05983 00
0760200  0       6988432. 1247671.   2583348. .071796
*
*******************************************************************
*    component 77 - sg-dc bottom part (4 tube region and bottom annulus)
*******************************************************************
*
0770000  dc4tube   pipe
0770001    9
0770101    0.0     9        *volume areas
0770201    0.0    8         *junction areas
0770301   1.481    1        *volume lengths
0770302   1.5      4        *volume lengths
0770303   1.0      5        *volume lengths
0770304   0.8      6        *volume lengths
0770305   0.6      7        *volume lengths
0770306   0.4      8        *volume lengths
0770307   0.2      9        *volume lengths
0770401  8.6429e-3  1       *volume volumes
0770402  8.7538e-3  4       *volume volumes
0770403  5.8359e-3  5       *volume volumes
0770404  4.6687e-3  6       *volume volumes
0770405  3.5015e-3  7       *volume volumes
0770406  2.3343e-3  8       *volume volumes
0770407  4.0563e-3  9       *volume volumes
0770601   -90.      9        *vertiical angles
0770801    4.57e-5   0.0431    9  *roughness  diam
0770901    0.0     0.0    7   *junction resistance
0770902    0.5     1.0    8   *junction resistance
0771001    00100       9    *flags pvbfe
0771101    01000      8     *flags vcahs
0771201    0     6986060. 1247739. 2583284. .0517344  0.  1
0771202    0     6995548. 1247816. 2583204. .0487328  0.  2
0771203    0     7005052. 1247899. 2583124. .0467894   0. 3
0771204    0     7004576. 1247988. 2583046. .0447651  0.  4
```

```
0771205    0     7012532. 1248050. 2582978. .0433005   0. 5
0771206    0     7018268. 1248102. 2582930. .0424226   0. 6
0771207    0     7022724. 1248145. 2582894. .0435893   0. 7
0771208    0     7025876. 1248196. 2582866. .0598894   0. 8
0771209    0     7028420. 1248220. 2582846. .02781746  0. 9
0771300    0
0771301    2.941365  1.779785    0. 1 *  8.31366
0771302    2.940042  1.7791977   0. 2 *  8.30743
0771303    2.945814  1.7799384   0. 3 *  8.30815
0771304    2.941764  1.7793686   0. 4 *  8.30803
0771305    2.948793  1.779058    0. 5 *  8.30793
0771306    2.947078  1.77928     0. 6 *  8.30804
0771307    2.94953   1.77196     0. 7 *  8.3067
0771308    2.944037  1.798198    0. 8 *  8.31625
0771401    .0431      0.        1.       1.    8
*
*******************************************************************
*    component 709 - feedwater source
*******************************************************************
*
7090000   feedwtr  tmdpvol
7090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
7090200   103   0
7090201    0.0   6.910e6   491.1
*
*******************************************************************
*    component 78 - top of steam dome
*******************************************************************
*
0780000   tstmdom   snglvol
0780101   0.0   0.4       0.13404   0.0   90.   0.4    4.57e-5 .653   00
0780200  0       6952032. 1247984.   2583424. 1.
*
*******************************************************************
*    component 79 - steamline
*******************************************************************
*
0790000  stmline   pipe
0790001   2
0790101    0.0   2          *volume areas
0790201    0.0   1          *junction areas
0790301   15.825 2          *volume lengths
0790401   34.25e-3 2        *volume volumes
0790601   -90.  2           *vertical angles
0790701   -8.049  2         *delta z
0790801   4.57e-5  0.0525  2   *roughness  diam
0790901   2.888   2.888   1   *junction loss coef
0791001   00   2            * fe
```

```
0791101   01000  1          *vcahs
0791201   0      6941284. 1247946. 2583452. 1.      0. 1
0791202   0      6931772. 1247971. 2583498. 1.      0. 2
0791300   0
0791301   6.25976  6.49588  0. 1 *  .283683
0791401   .0525    0.    1.   1.  1
*
*******************************************************************
*   feedwater
*******************************************************************
*
*******************************************************************
*    component 701 - feedwater junction
*******************************************************************
*
 7010000                "fedwtr"            tmdpjun
 7010101   709000000     075000000     0.0
 7010200      1           0           cntrlvar        273     * feedctl
 7010201  -1.0e+75           0.0           0.0           0.0
 7010202  -1.1e+10           0.0           0.0           0.0
 7010203  -1.0e+10        -1.0e+10         0.0           0.0
 7010204  -1.0e+9         -1.0e+9          0.0           0.0
 7010205  -1.0e+8          -1.0e+8          0.0           0.0
 7010206  -1.0e+7          -1.0e+7          0.0           0.0
 7010207  -1.0e+6          -1.0e+6          0.0           0.0
 7010208  -8.0e+5          -8.0e+5          0.0           0.0
 7010209  -6.0e+5          -6.0e+5          0.0           0.0
 7010210  -4.0e+5          -4.0e+5          0.0           0.0
 7010211  -2.0e+5          -2.0e+5          0.0           0.0
 7010212     0.0              0.0           0.0           0.0
 7010213   2.0e+5           2.0e+5          0.0           0.0
 7010214   4.0e+5           4.0e+5          0.0           0.0
 7010215   6.0e+5           6.0e+5          0.0           0.0
 7010216   8.0e+5           8.0e+5          0.0           0.0
 7010217   1.0e+6           1.0e+6          0.0           0.0
 7010218   1.0e+7           1.0e+7          0.0           0.0
 7010219   1.0e+8           1.0e+8          0.0           0.0
 7010220   1.0e+9           1.0e+9          0.0           0.0
 7010221   1.0e+10          1.0e+10         0.0           0.0
*
*******************************************************************
*    component 702 - junction between 11-tube and 4-tube regions
*******************************************************************
*
7020000   sgdwnc   sngljun
7020101   076010000  077000000 .005836  1.5   1.5   01000
7020201   0   3.3464  2.801928     0.  *  8.25925
7020110   .0431   0.    1.   1.
```

```
*
*******************************************************************
*    component 703 - downcomer to tube bundle
*******************************************************************
*
7030000   sgdcbot  sngljun
7030101  077010000  070000000 .025761 1.0    0.5     01000
7030201   0  .758816     .5368226   0.  *  8.30314
7030110   .02      0.     1.   1.
*
*******************************************************************
*    component 704 - steamdome to downcomer
*******************************************************************
*
7040000  sgdctop  sngljun
7040101  073010000  074000000 .09648  0.0    0.0     01000
7040201   0   6.98816     .01109985   0.  *  8.05694
7040110   .176    0.     1.   1.
*
*******************************************************************
*    component 705 - tube bundle to steam dome
*******************************************************************
*
7050000   ristodm   sngljun
7050101   070010000   071000000  .084496   0.0   0.0   01000
7050201   0   .1872706     .329899   0.  *  8.31636
7050110  0.328      0.   1.   1.
*
*******************************************************************
*    component 708 - top steam dome to steam line
*******************************************************************
*
7080000   tostmln  sngljun
7080101  078010000  079000000  .0011401      0.0   0.0   01100
7080201   0    6.396664 6.48532  0.  *  .2836816
7080110   .0381   0.     1.   1.
*
*******************************************************************
*    component 706 - steamline outlet
*******************************************************************
*
7060000            "trb st n"           valve
7060101   079010000     707000000    1.14e-3    0.0        0.0       00000
7060201     1                0.           .5234        0
7060300                   srvvlv
7060301       276             0  * steamctl...tcctl
7060401                    0.0          0.          0.0
7060402                    1.0       9357.2735      0.0  * this must be doubled
```

```
7060110     .0525    0.    1.   1.
*
*********************************************************************
*    component 707 - steamline sink volume
*********************************************************************
*
7070000   stmsink   tmdpvol
7070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
7070200   102   0
7070201   0.0   1.013e5   1.0
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*steam generator secondary system components - single loop  c
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*********************************************************************
*    component 80 - sg riser
*********************************************************************
*
0800000  tubebun   pipe
0800001   10
0800101   0.0    10        *volume areas
0800201   0.0    9         *junction areas
0800301   0.2     1       *volume lengths
0800302   0.4     2       *volume lengths
0800303   0.6     3       *volume lengths
0800304   0.8     4       *volume lengths
0800305   1.0     5       *volume lengths
0800306   1.5     9       *volume lengths
0800307   1.8025  10      *volume lengths
0800401   0.01151  1       *volume volumes
0800402   0.02303  2       *volume volumes
0800403   0.03454  3       *volume volumes
0800404   0.04605  4       *volume volumes
0800405   0.05756  5       *volume volumes
0800406   0.08635  9       *volume volumes
0800407   0.10376  10      *volume volumes
0800601   90.       10     *vertiical angles
0800801   4.57e-5   0.03503  10  *roughness  diam
0800901   0.709   0.709  9   *junction resistance
0801001   00100      10    *flags pvbfe
0801101   01000      9     *flags vcahs
0801201   0     7028456. 1248771. 2582846. .042479   0.  1
0801202   0     7026396. 1249808. 2582862. .0791885  0.  2
0801203   0     7023096. 1250779. 2582890. .100384   0.  3
0801204   0     7018676. 1251212. 2582926. .1024675  0.  4
0801205   0     7013236. 1251169. 2582972. .1001885 0.   5
```

```
0801206    0      7016020. 1250842. 2583030. .137237   0.  6
0801207    0      7017640. 1250435. 2583100. .1617664 0.   7
0801208    0      6999476. 1250028. 2583166. .20956   0.   8
0801209    0      6991468. 1249626. 2583234. .253402  0.  9
0801210    0      6982900. 1249192. 2583306. .319663  0.  10
0801300    0
0801301    .291368     .253318   0. 1 *  8.3189
0801302    .2968235     .3436065 0. 2 *  8.32017
0801303    .3058306    .414301   0. 3 *  8.32394
0801304    .318744     .485924    0. 4 *  8.32663
0801305    .3353457     .542248   0. 5 *  8.32915
0801306    .3635625    .6048185   0. 6 *  8.33147
0801307    .3908196    .661324    0. 7 *  8.33338
0801308    .417346      .713936   0. 8 *  8.33501
0801309    .444791     .775627    0. 9 *  8.33651
0801401    .03503     0.         1.        1.    9
*
*******************************************************************
*    component 81 - lower steam dome
*******************************************************************
*
0810000   lstmdom   pipe
0810001   3
0810101   0.0         3   *volume area
0810201   0.0         2   *junction area
0810301   0.158       1   *volume length
0810302   0.7925      2
0810303   0.900       3
0810401   0.010393    1   *volume volumes
0810402   0.03861     2   *volume volumes
0810403   0.04385     3   *volume volumes
0810601   90.         3
0810801   4.57e-5  .249   3   *rough  diam
0810901   0.0     0.0     2  *junction  f-loss  r-loss
0811001   00000   3          * vol flags
0811101   01000  2         * vcahs
0811201   0      6977848. 1248987. 2583346.  .1070403 0. 1
0811202   0      6965112. 1248752. 2583374.  .124302  0. 2
0811203   0      6969880. 1248488. 2583418.  .1005756  0. 3
0811300   0
0811301    .426618   1.271086  0. 1  *  8.28098
0811302    .432377    1.227373 0. 2  *  8.30996
0811401   .249     0.    1.   1.  2
*
*******************************************************************
*    component 82 - middle steam dome and separator
*******************************************************************
*
```

```
0820000  mstmdom   branch
0820001    3    0
0820101  0.0   2.16    0.59549   0.0  90.  2.16   4.57e-5 .249   00
0820200  0       6953520. 1248202.   2583470. .64374
0821101  082010000  088000000  .502655    .816   .452   01000
0822101  082000000  083000000  44.915e-2   .060   .014   01002
0823101  081010000  082000000  4.8695e-2  0.0  0.0      01000
0821201   -0.49608   .04985623 0.  *  .283642
0822201   .3790846   2.01394252  0.  *  8.05382
0823201   .50494     2.04995    0.  *  8.2958
0821110   .800     0.    1.   1.
0822110   .539     0.    1.   1.
0823110   .249     0.    1.   1.
*
*******************************************************************
*    component 83 - upper downcomer
*******************************************************************
*
0830000  updwnc   snglvol
0830101    0.0    0.3375  .14922   0.0  -90.   -.3375   4.57e-5 .539  00
0830200  0      6953596.  1248164.   2583470. .594008
*
*******************************************************************
*    component 84 - upper feedwater ring
*******************************************************************
*
0840000   ufwring  snglvol
0840101  0.0    1.6055   0.15856   0.0  -90.  -1.6055  4.57e-5 0.176  00
0840200  0     6965196. 1248192.   2583464. .388591
*
*******************************************************************
*    component 85 - lower feedwater ring
*******************************************************************
*
0850000   lfwring   branch
0850001    2     0
0850101  0.0    .8275     .08172    0.0  -90.   -.8275  4.57e-5 .176  00
0850200  0       6970192. 1246853.   2583416. .022155
0851101  084010000  085000000    .09648      0.0   0.0    01000
0852101  085010000  086000000   3.0415e-2    .339  .459   01000
0851201    .2679376   .09100312  0.  *  8.05953
0852201    .651864  0.076746   0.  *  10.24751
0851110    .176    0.    1.   1.
0852110   .05983   0.    1.   1.
*
*******************************************************************
*    component 86 - 11 tube region
*******************************************************************
```

```
*
0860000   dc11tube  snglvol
0860101   0.0   1.9815  0.06336    0.0   -90.    -1.9815  4.57e-5 .05983 00
0860200  0        6988432. 1247671.    2583348. .071796
*
*********************************************************************
*    component 87 - sg-dc bottom part (4 tube region and bottom annulus)
*********************************************************************
*
0870000  dc4tube   pipe
0870001    9
0870101    0.0     9         *volume areas
0870201    0.0    8          *junction areas
0870301   1.481     1        *volume lengths
0870302   1.5       4        *volume lengths
0870303   1.0       5        *volume lengths
0870304   0.8       6        *volume lengths
0870305   0.6       7        *volume lengths
0870306   0.4       8        *volume lengths
0870307   0.2       9        *volume lengths
0870401  8.6429e-3  1         *volume volumes
0870402  8.7538e-3  4         *volume volumes
0870403  5.8359e-3  5         *volume volumes
0870404  4.6687e-3  6         *volume volumes
0870405  3.5015e-3  7         *volume volumes
0870406  2.3343e-3  8         *volume volumes
0870407  4.0563e-3  9         *volume volumes
0870601   -90.      9         *vertiical angles
0870801    4.57e-5   0.0431    9  *roughness  diam
0870901    0.0     0.0    7   *junction resistance
0870902    0.5     1.0    8   *junction resistance
0871001    00100       9     *flags pvbfe
0871101    01000      8      *flags vcahs
0871201    0      6986060. 1247739. 2583284. .0517344  0.  1
0871202    0      6995548. 1247816. 2583204. .0487328  0.  2
0871203    0      7005052. 1247899. 2583124. .0467894   0. 3
0871204    0      7004576. 1247988. 2583046. .0447651  0.  4
0871205    0      7012532. 1248050. 2582978. .0433005   0. 5
0871206    0      7018268. 1248102. 2582930. .0424226   0. 6
0871207    0      7022724. 1248145. 2582894. .0435893   0. 7
0871208    0      7025876. 1248196. 2582866. .0598894   0. 8
0871209    0      7028420. 1248220. 2582846. .02781746  0. 9
0871300    0
0871301    2.943655   1.79785    0. 1 *  8.31366
0871302    2.940042   1.791977   0. 2 *  8.30743
0871303    2.945814   1.799384   0. 3 *  8.30815
0871304    2.941764   1.793686   0. 4 *  8.30803
0871305    2.948793   1.79058    0. 5 *  8.30793
```

```
0871306    2.947078   1.7928      0. 6 *  8.30804
0871307    2.94953    1.7996      0. 7 *  8.3067
0871308    2.944037   1.79198     0. 8 *  8.31625
0871401    .0431      0.         1.        1.    8
*
*******************************************************************
*    component 809 - feedwater source
*******************************************************************
*
8090000   feedwtr  tmdpvol
8090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
8090200   103   0
8090201    0.0   6.910e6   491.1
*
*******************************************************************
*    component 88 - top of steam dome
*******************************************************************
*
0880000   tstmdom   snglvol
0880101   0.0   0.4       0.13404   0.0   90.   0.4    4.57e-5 .653   00
0880200  0       6952032. 1247984.   2583424. 1.
*
*******************************************************************
*    component 89 - steamline
*******************************************************************
*
0890000  stmline   pipe
0890001   2
0890101    0.0   2          *volume areas
0890201    0.0   1          *junction areas
0890301   15.825 2          *volume lengths
0890401   34.25e-3 2        *volume volumes
0890601   -90.  2           *vertical angles
0890701   -8.049  2         *delta z
0890801   4.57e-5  0.0525  2   *roughness  diam
0890901   2.888   2.888   1   *junction loss coef
0891001   00   2            * fe
0891101   01000  1          *vcahs
0891201   0     6941284. 1247946. 2583452. 1.      0. 1
0891202   0     6931772. 1247971. 2583498. 1.      0. 2
0891300   0
0891301   6.25976  6.49588  0. 1 *  .283683
0891401   .0525    0.    1.   1.  1
*
*******************************************************************
*   feedwater
*******************************************************************
*
```

```
*******************************************************************
*    component 801 - feedwater junction
*******************************************************************
*
 8010000                "fedwtr"           tmdpjun
 8010101   809000000     085000000     0.0-
 8010200      1            0          cntrlvar        283     * feedctl
 8010201  -1.0e+75           0.0           0.0              0.0
 8010202  -1.1e+10           0.0           0.0              0.0
 8010203  -1.0e+10        -1.0e+10         0.0              0.0
 8010204  -1.0e+9         -1.0e+9          0.0              0.0
 8010205  -1.0e+8         -1.0e+8          0.0              0.0
 8010206  -1.0e+7         -1.0e+7          0.0              0.0
 8010207  -1.0e+6         -1.0e+6          0.0              0.0
 8010208  -8.0e+5         -8.0e+5          0.0              0.0
 8010209  -6.0e+5         -6.0e+5          0.0              0.0
 8010210  -4.0e+5         -4.0e+5          0.0              0.0
 8010211  -2.0e+5         -2.0e+5          0.0              0.0
 8010212     0.0             0.0           0.0              0.0
 8010213   2.0e+5          2.0e+5          0.0              0.0
 8010214   4.0e+5          4.0e+5          0.0              0.0
 8010215   6.0e+5          6.0e+5          0.0              0.0
 8010216   8.0e+5          8.0e+5          0.0              0.0
 8010217   1.0e+6          1.0e+6          0.0              0.0
 8010218   1.0e+7          1.0e+7          0.0              0.0
 8010219   1.0e+8          1.0e+8          0.0              0.0
 8010220   1.0e+9          1.0e+9          0.0              0.0
 8010221   1.0e+10         1.0e+10         0.0              0.0
*
*******************************************************************
*    component 802 - junction between 11-tube and 4-tube regions
*******************************************************************
*
8020000   sgdwnc   sngljun
8020101   086010000  087000000 .005836  1.5   1.5   01000
8020201   0   3.3464  2.801928     0.  *  8.25925
8020110   .0431   0.    1.   1.
*
*******************************************************************
*    component 803 - downcomer to tube bundle
*******************************************************************
*
8030000   sgdcbot  sngljun
8030101  087010000  080000000 .025761 1.0   0.5    01000
8030201   0  .758816    .5358226   0.  *  8.30314
8030110   .02     0.    1.   1.
*
*******************************************************************
```

```
*    component 804 - steamdome to downcomer
*******************************************************************
*
8040000  sgdctop  sngljun
8040101  083010000  084000000 .09648  0.0   0.0    01000
8040201  0  6.98816   .01109985   0.  *  8.05694
8040110   .176    0.    1.   1.
*
*******************************************************************
*    component 805 - tube bundle to steam dome
*******************************************************************
*
8050000   ristodm   sngljun
8050101   080010000   081000000  .084496   0.0   0.0   01000
8050201   0   .1872706    .329899   0.  *  8.31636
8050110  0.328     0.   1.   1.
*
*******************************************************************
*    component 808 - top steam dome to steam line
*******************************************************************
*
8080000   tostmln  sngljun
8080101  088010000  089000000  .0011401     0.0   0.0   01100
8080201   0    6.396664 6.48532  0.  *  .2836816
8080110   .0381   0.    1.   1.
*
*******************************************************************
*    component 806 - steamline outlet
*******************************************************************
*
8060000            "trb st n"           valve
8060101   089010000     807000000    1.14e-3    0.0       0.0      00000
8060201     1               0.          .5234        0
8060300                   srvvlv
8060301       286             0  * steamctl...tcctl
8060401                    0.0          0.          0.0
8060402                    1.0       9357.2735      0.0
8060110     .0525    0.    1.   1.
*
*******************************************************************
*    component 807 - steamline sink volume
*******************************************************************
*
8070000   stmsink   tmdpvol
8070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
8070200   102   0
8070201   0.0   1.013e5   1.0
*
```

```
************************************************************************
*  reactor vessel heat structures
************************************************************************
*
**************************************
*  core heater rod heat structures
**************************************
*
10131000   12    8    2    1      0.0
10131100    0    1
10131101    4    0.00415
10131102    3    0.00475
10131201    2    4
10131202    1    7
10131301  1.0    4
10131302  0.0    7
10131401  623.   5
10131402  573.   8
10131501    0    0    0    0    0.0    1
10131502    0    0    0    0    0.0    2
10131503    0    0    0    0    0.0    3
10131504    0    0    0    0    0.0    4
10131505    0    0    0    0    0.0    5
10131506    0    0    0    0    0.0    6
10131507    0    0    0    0    0.0    7
10131508    0    0    0    0    0.0    8
10131509    0    0    0    0    0.0    9
10131510    0    0    0    0    0.0   10
10131511    0    0    0    0    0.0   11
10131512    0    0    0    0    0.0   12
10131601    013020000    0    1    0    6.744    1
10131602    013020000    0    1    0    3.321    2
10131603    013030000    0    1    0    3.321    5
10131604    013040000    0    1    0    3.321    7
10131605    013050000    0    1    0    3.321   10
10131606    013060000    0    1    0    3.321   11
10131607    013060000    0    1    0    6.744   12
10131701    1    0.076480  0    0    1
10131702    1    0.049032  0    0    2
10131703    1    0.068217  0    0    3
10131704    1    0.087402  0    0    4
10131705    1    0.105168  0    0    5
10131706    1    0.113701  0    0    6
10131707    1    0.113701  0    0    7
10131708    1    0.105168  0    0    8
10131709    1    0.087402  0    0    9
10131710    1    0.068217  0    0   10
10131711    1    0.049032  0    0   11
```

```
10131712    1    0.076480  0    0   12
10131801    0.0 10. 10. 0. 0. 0. 0. 1.0  12
10131901    1.178e-2  10. 10. 0. 0. 0. 0. 1.0  12
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*  core baffle heat structure
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
10141000   7    4    2    1    0.214572     0
10141100    0  1
10141101     3              .215772
10141201     1   3
10141301    0.0  3
10141401    588.8   4
10141501    013010000   00000     1     1     0.11      1
10141502    013020000   00000     1     1     0.788     2
10141503    013030000   00000     1     1     0.78      3
10141504    013040000   00000     1     1     0.52      4
10141505    013050000   00000     1     1     0.78      5
10141506    013060000   00000     1     1     0.788     6
10141507    013070000   00000     1     1     0.35      7
10141601    014010000   00000     1     1     0.11      1
10141602    014020000   00000     1     1     0.788     2
10141603    014030000   00000     1     1     0.78      3
10141604    014040000   00000     1     1     0.52      4
10141605    014050000   00000     1     1     0.78      5
10141606    014060000   00000     1     1     0.788     6
10141607    014070000   00000     1     1     0.35      7
10141701    0     0.0     0.0     0.0    7
10141801  0.0 10. 10. 0. 0. 0. 0. 1.0 7
10141901  0.0 10. 10. 0. 0. 0. 0. 1.0 7
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  lowest part of pressure vessel
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10110000   1    4    2    1    0.250000     0
10110100    0  1
10110101     3              0.282000
10110201     1   3
10110301    0.0  3
10110401    558.8   4
10110501    011010000   00000     1     1     1.54900  1
10110601    000000000   00000     0     1     1.549    1
10110701    0     0.0     0.0     0.0    1
10110801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10110901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
```

```
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  lowest 2nd-part of pressure vessel
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10120000   1     4    2    1    0.171500      0
10120100    0  1
10120101      3            0.181500
10120201      1   3
10120301    0.0  3
10120401    558.8   4
10120501    012010000    00000    1    1    0.51985  1
10120601    022070000    00000    1    1    0.51985  1
10120701    0     0.0     0.0     0.0    1
10120801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10120901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  pressure vessel surrounded by core bypass volume
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10140000   7     4    2    1    0.171500      0
10140100    0  1
10140101      3            0.199500
10140201      1   3
10140301    0.0  3
10140401    558.8   4
10140501    014010000    00000    1    1    0.12353  1
10140502    014020000    00000    1    1    0.86882  2
10140503    014030000    00000    1    1    0.86000  3
10140504    014040000    00000    1    1    0.57334  4
10140505    014050000    00000    1    1    0.86000  5
10140506    014060000    00000    1    1    0.86882  6
10140507    014070000    00000    1    1    0.12353  7
10140601    000000000    00000    0    1    0.12353  1
10140602    000000000    00000    0    1    0.86882  2
10140603    000000000    00000    0    1    0.86000  3
10140604    000000000    00000    0    1    0.57334  4
10140605    000000000    00000    0    1    0.86000  5
10140606    000000000    00000    0    1    0.86882  6
10140607    000000000    00000    0    1    0.12353  7
10140701    0     0.0     0.0     0.0    7
10140801  0.0 10. 10. 0. 0. 0. 0. 1.0 7
10140901  0.0 10. 10. 0. 0. 0. 0. 1.0 7
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper part of pressure vessel
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10990000   1     4    2    1    0.171500      0
10990100    0  1
```

```
10990101      3            0.199500
10990201      1   3
10990301     0.0  3
10990401     558.8   4
10990501     099010000   00000    1    1    0.55248  1
10990601     000000000   00000    0    1    0.55248  1
10990701     0     0.0    0.0     0.0   1
10990801  0.0 10.  10. 0. 0. 0. 0. 1.0 1
10990901  0.0 10.  10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper plenum of pressure vessel
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10150000   1     4    2    1    0.171500      0
10150100    0  1
10150101      3            0.199500
10150201      1   3
10150301     0.0  3
10150401     558.8   4
10150501     015010000   00000    1    1    1.02406  1
10150601     000000000   00000    0    1    1.02406  1
10150701     0     0.0    0.0     0.0   1
10150801  0.0 10.  10. 0. 0. 0. 0. 1.0 1
10150901  0.0 10.  10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  extended upper plenum structure
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10160000   1     4    2    1    0.171500      0
10160100    0  1
10160101      3            0.199500
10160201      1   3
10160301     0.0  3
10160401     558.8   4
10160501     016010000   00000    1    1    0.75747  1
10160601     000000000   00000    0    1    0.75747  1
10160701     0     0.0    0.0     0.0   1
10160801  0.0 10.  10. 0. 0. 0. 0. 1.0 1
10160901  0.0 10.  10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper plenum to upper head side structure ( part1 )
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10161000   1     4    2    1    0.129000      0
10161100    0  1
10161101      3            0.146000
10161201      1   3
10161301     0.0  3
```

```
10161401    558.8   4
10161501    016010000   00000   1   1   0.57534  1
10161601    019010000   00000   1   1   0.57534  1
10161701    0    0.0    0.0    0.0   1
10161801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10161901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper plenum to upper head side structure ( part 2)
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10162000   1     4    2    1    0.100000     0
10162100    0  1
10162101      3            0.105000
10162201      1   3
10162301    0.0  3
10162401    558.8   4
10162501    016010000   00000   1   1   0.86798  1
10162601    019010000   00000   1   1   0.86798  1
10162701    0    0.0    0.0    0.0   1
10162801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10162901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper plenum to upper head side structure ( part 3) : rectangular
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10163000   1     4    1    1    0.000000     0
10163100    0  1
10163101      3            0.010000
10163201      1   3
10163301    0.0  3
10163401    558.8   4
10163501    016010000   00000   1   1   0.01670  1
10163601    018010000   00000   1   1   0.01670  1
10163701    0    0.0    0.0    0.0   1
10163801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10163901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper plenum to upper head side structure ( part 4) : rectangular
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10164000   1     4    1    1    0.000000     0
10164100    0  1
10164101      3            0.035000
10164201      1   3
10164301    0.0  3
10164401    558.8   4
10164501    016010000   00000   1   1   0.12900  1
10164601    019010000   00000   1   1   0.12900  1
```

```
10164701    0     0.0     0.0     0.0    1
10164801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10164901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
* --upper head structure ( part 1 )
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10180000   1     4    2    1    0.190000      0
10180100    0  1
10180101      3           0.218000
10180201      1   3
10180301    0.0  3
10180401    558.8   4
10180501    018010000   00000    1    1    0.37030  1
10180601    000000000   00000    0    1    0.37030  1
10180701    0     0.0     0.0     0.0    1
10180801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10180901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper head structure ( part 2 )
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10190000   1     4    2    1    0.190000      0
10190100    0  1
10190101      3           0.218000
10190201      1   3
10190301    0.0  3
10190401    558.8   4
10190501    019010000   00000    1    1    2.72586  1
10190601    000000000   00000    0    1    2.72586  1
10190701    0     0.0     0.0     0.0    1
10190801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10190901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upperhead to downcomer structure
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10210000   3     4    2    1    0.024600      0
10210100    0  1
10210101      3           0.030150
10210201      1   3
10210301    0.0  3
10210401    558.8   4
10210501    021010000   00000    1    1    9.25200  1
10210502    021020000   00000    1    1    6.00900  2
10210503    021030000   00000    1    1    1.10200  3
10210601    000000000   00000    0    1    9.25200  1
10210602    000000000   00000    0    1    6.00900  2
```

```
10210603    000000000   00000    0    1    1.10200  3
10210701    0     0.0     0.0     0.0    3
10210801  0.0 10. 10. 0. 0. 0. 0. 1.0 3
10210901  0.0 10. 10. 0. 0. 0. 0. 1.0 3
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  upper downcomer : connecting cold legs
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10200000   1    4    2    1    0.125000     0
10200100    0  1
10200101      3           0.164150
10200201      1   3
10200301    0.0  3
10200401    558.8  .4
10200501    020010000   00000    1    1    0.92300  1
10200601    000000000   00000    0    1    0.923    1
10200701    0     0.0     0.0     0.0    1
10200801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10200901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  internal trefoil shaped pieces in upper downcomer : Recangular
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10201000   1    4    1    1    0.000000     0
10201100    0  1
10201101      3           0.003000
10201201      1   3
10201301    0.0  3
10201401    558.8   4
10201501    020010000   00000    1    1    0.33000  1
10201601    000000000   00000    0    1    0.33     1
10201701    0     0.0     0.0     0.0    1
10201801  0.0 10. 10. 0. 0. 0. 0. 1.0 1
10201901  0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  downcomer heat structure
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10220000   6    4    2    1    0.086500     0
10220100    0  1
10220101      3           0.105000
10220201      1   3
10220301    0.0  3
10220401    558.8   4
10220501    022010000   00000    1    1    1.41700  1
10220502    022020000   00000    1    1    1.41700  2
10220503    022030000   00000    1    1    1.41700  3
10220504    022040000   00000    1    1    1.41700  4
```

```
10220505     022050000    00000     1     1     0.40900  5
10220506     022060000    00000     1     1     0.58900  6
10220601     000000000    00000     0     1     1.41700  1
10220602     000000000    00000     0     1     1.41700  2
10220603     000000000    00000     0     1     1.41700  3
10220604     000000000    00000     0     1     1.41700  4
10220605     000000000    00000     0     1     0.40900  5
10220606     000000000    00000     0     1     0.58900  6
10220701     0     0.0     0.0     0.0    6
10220801   0.0 10. 10. 0. 0. 0. 0. 1.0 6
10220901   0.0 10. 10. 0. 0. 0. 0. 1.0 6
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*  lower downcomer : connecting lower plenum
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
10221000   1     4     2     1     0.199000     0
10221100     0  1
10221101       3            0.247000
10221201       1    3
10221301     0.0  3
10221401     558.8   4
10221501     022070000    00000     1     1     0.80202  1
10221601     000000000    00000     0     1     0.80202  1
10221701     0     0.0     0.0     0.0    1
10221801   0.0 10. 10. 0. 0. 0. 0. 1.0 1
10221901   0.0 10. 10. 0. 0. 0. 0. 1.0 1
*
*
*******************************************************************
*                   loop heat structures
*******************************************************************
*
*********************************************************************
*                  ht str no. 31, 32, 33
*********************************************************************
*
10311000     21        6        2        1      0.059       0
10311100            0                   1
10311101            5                  0.075
10311201            1                   5
10311301        0.0                     5
10311400                                0
10311401        563.300                    6
10311501    031010000    10000    1        1        1.1941         1
10311502    032010000    10000    1        1        0.5            2
10311503    033010000    10000    1        1        0.7977         3
10311504    033020000    0        1        1        1.4480         4
10311505    033030000    0        1        1        0.5506         5
```

```
10311506   034010000   0       1        1        0.7980          6
10311507   034220000   0       1        1        0.7980          7
10311508   041010000   10000   1        1        1.1941          8
10311509   042010000   10000   1        1        0.5             9
10311510   043010000   10000   1        1        0.7977          10
10311511   043020000   0       1        1        1.4480          11
10311512   043030000   0       1        1        0.5506          12
10311513   044010000   0       1        1        0.7980          13
10311514   044220000   0       1        1        0.7980          14
10311515   051010000   10000   1        1        1.1941          15
10311516   052010000   10000   1        1        0.5941          16
10311517   053010000   10000   1        1        0.7977          17
10311518   053020000   0       1        1        1.4480          18
10311519   053030000   0       1        1        0.5506          19
10311520   054010000   0       1        1        0.7980          20
10311521   054220000   0       1        1        0.7980          21
10311601   000000000   10000   0        1        1.1941          1
10311602   000000000   10000   0        1        0.5             2
10311603   000000000   10000   0        1        0.7977          3
10311604   000000000   0       0        1        1.4480          4
10311605   000000000   0       0        1        0.5506          5
10311606   000000000   0       0        1        0.7980          6
10311607   000000000   0       0        1        0.7980          7
10311608   000000000   10000   0        1        1.1941          8
10311609   000000000   10000   0        1        0.5             9
10311610   000000000   10000   0        1        0.7977          10
10311611   000000000   0       0        1        1.4480          11
10311612   000000000   0       0        1        0.5506          12
10311613   000000000   0       0        1        0.7980          13
10311614   000000000   0       0        1        0.7980          14
10311615   000000000   10000   0        1        1.1941          15
10311616   000000000   10000   0        1        0.5941          16
10311617   000000000   10000   0        1        0.7977          17
10311618   000000000   0       0        1        1.4480          18
10311619   000000000   0       0        1        0.5506          19
10311620   000000000   0       0        1        0.7980          20
10311621   000000000   0       0        1        0.7980          21
10311701      0           0            0        0               21
10311801      0.       10.0   10.0 0.  0.   0.   0.   1.        21
10311901      0.        10.0  10.0 0.  0.   0.   0.   1.        21
*
*********************************************************************
*                ht str no. 35, 45, 55
*********************************************************************
10351000   15     6     2     1     0.059     0
10351100          0           1
10351101          5           0.075
10351201          1           5
```

```
10351301        0.0                 5
10351400                            0
10351401          559.000           6
10351501   035010000   0       1       1       0.4189          1
10351502   035020000   0       1       1       1.94015         2
10351503   035030000   0       1       1       2.22285         3
10351504   035040000   0       1       1       0.820           4
10351505   035050000   10000   1       1       2.0697          5
10351506   045010000   0       1       1       0.4189          6
10351507   045020000   0       1       1       1.94015         7
10351508   045030000   0       1       1       2.22285         8
10351509   045040000   0       1       1       0.820           9
10351510   045050000   10000   1       1       2.0697          10
10351511   055010000   0       1       1       0.4189          11
10351512   055020000   0       1       1       1.94015         12
10351513   055030000   0       1       1       2.22285         13
10351514   055040000   0       1       1       0.820           14
10351515   055050000   0       1       1       2.0697          15
10351601   000000000   0       0       1       0.4189          1
10351602   000000000   0       0       1       1.94015         2
10351603   000000000   0       0       1       2.22285         3
10351604   000000000   0       0       1       0.820           4
10351605   000000000   0       0       1       2.0697          5
10351606   000000000   0       0       1       0.4189          6
10351607   000000000   0       0       1       1.94015         7
10351608   000000000   0       0       1       2.22285         8
10351609   000000000   0       0       1       0.820           9
10351610   000000000   0       0       1       2.0697          10
10351611   000000000   0       0       1       0.4189          11
10351612   000000000   0       0       1       1.94015         12
10351613   000000000   0       0       1       2.22285         13
10351614   000000000   0       0       1       0.820           14
10351615   000000000   0       0       1       2.0697          15
10351701        0           0           0         0             15
10351801        0.      10.0    10.0    0.  0.    0.  0. 1.    15
10351901        0.      10.0    10.0    0.  0.    0.  0. 1.    15
*
**********************************************************************
*                  ht str no. 36-1, 46-1, 56-1
**********************************************************************
*
10361000   3       6       2       1       0.059       0
10361100            0               1
10361101            5               0.060
10361201            1               5
10361301         0.0                5
10361400                            0
10361401         559.               6
```

```
10361501   036010000   0        1        1        0.350          1
10361502   046010000   0        1        1        0.350          2
10361503   056010000   0        1        1        0.350          3
10361601   000000000   0        2777     1        0.350          1
10361602   000000000   0        2777     1        0.350          2
10361603   000000000   0        2777     1        0.350          3
10361701        0           0             0          0           3
10361801        0.       10.0    10.0     0.   0.    0.   0.  1.  3
10361901        0.       10.0    10.0     0.   0.    0.   0.  1.  3
*
**********************************************************************
*                  ht str no. 36-2, 46-2, 56-2
**********************************************************************
*
10362000     3      6      2      1      0.059      0
10362100             0               1
10362101             5              0.06008
10362201             1               5
10362301          0.0                5
10362400                             0
10362401          559.               6
10362501   036010000   0        1        1        0.35           1
10362502   046010000   0        1        1        0.35           2
10362503   056010000   0        1        1        0.35           3
10362601   000000000   0        2778     1        0.35           1
10362602   000000000   0        2778     1        0.35           2
10362603   000000000   0        2778     1        0.35           3
10362701        0           0             0          0           3
10362801        0.       10.0    10.0     0.   0.    0.   0.  1.  3
10362901        0.       10.0    10.0     0.   0.    0.   0.  1.  3
*
**********************************************************************
*                  ht str no. 37, 38, 39
**********************************************************************
10371000    15      6      2      1      0.059      0
10371100             0               1
10371101             5              0.075
10371201             1               5
10371301          0.0                5
10371400                             0
10371401            559.000            6
10371501   037010000   0        1        1        1.05           1
10371502   037020000   10000    1        1        8.59           2
10371503   038010000   10000    1        1        0.5            3
10371504   039010000   0        1        1        0.78406        4
10371505   039020000   10000    1        1        0.53586        5
10371506   047010000   0        1        1        1.05           6
10371507   047020000   10000    1        1        8.59           7
```

```
10371508   048010000   10000   1       1       0.5        8
10371509   049010000   0       1       1       0.78406    9
10371510   049020000   10000   1       1       0.53586    10
10371511   057010000   0       1       1       1.05       11
10371512   057020000   10000   1       1       8.59       12
10371513   058010000   10000   1       1       0.5        13
10371514   059010000   0       1       1       0.78406    14
10371515   059020000   0       1       1       0.53586    15
10371601   000000000   0       0       1       1.05       1
10371602   000000000   0       0       1       8.59       2
10371603   000000000   0       0       1       0.5        3
10371604   000000000   0       0       1       0.78406    4
10371605   000000000   0       0       1       0.53586    5
10371606   000000000   0       0       1       1.05       6
10371607   000000000   0       0       1       8.59       7
10371608   000000000   0       0       1       0.5        8
10371609   000000000   0       0       1       0.78406    9
10371610   000000000   0       0       1       0.53586    10
10371611   000000000   0       0       1       1.05       11
10371612   000000000   0       0       1       8.59       12
10371613   000000000   0       0       1       0.5        13
10371614   000000000   0       0       1       0.78406    14
10371615   000000000   0       0       1       0.53586    15
10371701      0          0             0       0          15
10371801      0.       10.0    10.0  0. 0. 0.    0.   1.    15
10371901      0.    10.  10.  0.  0.  0.  0.  1.  15
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*     steam generator tubes heat structures (single loop)
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
10341000   20    4    2    1    0.00984
10341100   0     1
10341101   3     0.01111
10341201   3     3
10341301   0.0   3
10341401   560.    4
10341501   034020000   10000   1   0    .42042   1
10341502   034030000   10000   1   0    .84084   2
10341503   034040000   10000   1   0   1.26126   3
10341504   034050000   10000   1   0   1.68168   4
10341505   034060000   10000   1   0   2.10210   5
10341506   034070000   10000   1   0   3.15315   9
10341507   034110000   10000   1   0   1.52402   11
10341508   034130000   10000   1   0   3.15315   15
10341509   034170000   10000   1   0   2.10210   16
```

```
10341510    034180000   10000    1    0    1.68168    17
10341511    034190000   10000    1    0    1.26126    18
10341512    034200000   10000    1    0     .84084    19
10341513    034210000   10000    1    0     .42042    20
10341601    060010000   10000    1    0     .47468    1
10341602    060020000   10000    1    0     .94936    2
10341603    060030000   10000    1    0    1.42405    3
10341604    060040000   10000    1    0    1.89873    4
10341605    060050000   10000    1    0    2.37341    5
10341606    060060000   10000    1    0    3.56012    9
10341607    060100000   10000    1    0    1.72072    10
10341608    060100000  -10000    1    0    1.72072    11
10341609    060090000  -10000    1    0    3.56012    15
10341610    060050000  -10000    1    0    2.37341    16
10341611    060040000  -10000    1    0    1.89873    17
10341612    060030000  -10000    1    0    1.42405    18
10341613    060020000  -10000    1    0     .94936    19
10341614    060010000  -10000    1    0     .47468    20
10341701    0     0.0     0.0     0.0     20
10341801  0.01968 10. 10. 0. 0. 0. 0. 1.0  20
10341901  .03503  10. 10. 0. 0. 0. 0. 1.0  20 * d=inter tube dist.
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*steam generator tubes heat structures : loop b
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
10441000    20    4    2    1    0.00984
10441100    0     1
10441101    3     0.01111
10441201    3     3
10441301    0.0   3
10441401    560.    4
10441501    044020000   10000    1    0     .42042    1
10441502    044030000   10000    1    0     .84084    2
10441503    044040000   10000    1    0    1.26126    3
10441504    044050000   10000    1    0    1.68168    4
10441505    044060000   10000    1    0    2.10210    5
10441506    044070000   10000    1    0    3.15315    9
10441507    044110000   10000    1    0    1.52402    11
10441508    044130000   10000    1    0    3.15315    15
10441509    044170000   10000    1    0    2.10210    16
10441510    044180000   10000    1    0    1.68168    17
10441511    044190000   10000    1    0    1.26126    18
10441512    044200000   10000    1    0     .84084    19
10441513    044210000   10000    1    0     .42042    20
10441601    070010000   10000    1    0     .47468    1
```

```
10441602     070020000   10000     1    0     .94936   2
10441603     070030000   10000     1    0    1.42405   3
10441604     070040000   10000     1    0    1.89873   4
10441605     070050000   10000     1    0    2.37341   5
10441606     070060000   10000     1    0    3.56012   9
10441607     070100000   10000     1    0    1.72072   10
10441608     070100000  -10000     1    0    1.72072   11
10441609     070090000  -10000     1    0    3.56012   15
10441610     070050000  -10000     1    0    2.37341   16
10441611     070040000  -10000     1    0    1.89873   17
10441612     070030000  -10000     1    0    1.42405   18
10441613     070020000  -10000     1    0     .94936   19
10441614     070010000  -10000     1    0     .47468   20
10441701   0     0.0     0.0     0.0     20
10441801   0.01968 10. 10. 0. 0. 0. 0. 1.0  20
10441901   .03503  10. 10. 0. 0. 0. 0. 1.0  20 * d=inter tube dist.
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
*steam generator tubes heat structures( loop c)
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
10541000   20    4    2    1    0.00984
10541100    0    1
10541101    3    0.01111
10541201    3    3
10541301    0.0  3
10541401    560.    4
10541501    054020000   10000     1    0     .42042   1
10541502    054030000   10000     1    0     .84084   2
10541503    054040000   10000     1    0    1.26126   3
10541504    054050000   10000     1    0    1.68168   4
10541505    054060000   10000     1    0    2.10210   5
10541506    054070000   10000     1    0    3.15315   9
10541507    054110000   10000     1    0    1.52402   11
10541508    054130000   10000     1    0    3.15315   15
10541509    054170000   10000     1    0    2.10210   16
10541510    054180000   10000     1    0    1.68168   17
10541511    054190000   10000     1    0    1.26126   18
10541512    054200000   10000     1    0     .84084   19
10541513    054210000   10000     1    0     .42042   20
10541601    080010000   10000     1    0     .47468   1
10541602    080020000   10000     1    0     .94936   2
10541603    080030000   10000     1    0    1.42405   3
10541604    080040000   10000     1    0    1.89873   4
10541605    080050000   10000     1    0    2.37341   5
10541606    080060000   10000     1    0    3.56012   9
```

```
10541607    080100000   10000    1    0   1.72072   10
10541608    080100000  -10000    1    0   1.72072   11
10541609    080090000  -10000    1    0   3.56012   15
10541610    080050000  -10000    1    0   2.37341   16
10541611    080040000  -10000    1    0   1.89873   17
10541612    080030000  -10000    1    0   1.42405   18
10541613    080020000  -10000    1    0    .94936   19
10541614    080010000  -10000    1    0    .47468   20
10541701    0    0.0    0.0    0.0    20
10541801 0.01968 10. 10. 0. 0. 0. 0. 1.0  20
10541901  .03503  10. 10. 0. 0. 0. 0. 1.0  20 * d=inter tube dist.
*
*
*********************************************************************
*                  ht str no. 60, 70, 80
*********************************************************************
*
10601000    30      6     2     1     0.028775  0
10601100            0             1
10601101            5             0.03555
10601201            1             5
10601301         0.0              5
10601400         0
10601401       560.0              6
10601501   060010000   0       1       1       0.2          1
10601502   060020000   0       1       1       0.4          2
10601503   060030000   0       1       1       0.6          3
10601504   060040000   0       1       1       0.8          4
10601505   060050000   10000   1       1       1.0          5
10601506   060090000   0       1       1       1.5          9
10601507   060100000   0       1       1       1.8025       10
10601508   070010000   0       1       1       0.2          11
10601509   070020000   0       1       1       0.4          12
10601510   070030000   0       1       1       0.6          13
10601511   070040000   0       1       1       0.8          14
10601512   070050000   10000   1       1       1.0          15
10601513   070090000   0       1       1       1.5          19
10601514   070100000   0       1       1       1.8025       20
10601515   080010000   0       1       1       0.2          21
10601516   080020000   0       1       1       0.4          22
10601517   080030000   0       1       1       0.6          23
10601518   080040000   0       1       1       0.8          24
10601519   080050000   10000   1       1       1.0          25
10601520   080090000   0       1       1       1.5          29
10601521   080100000   0       1       1       1.8025       30
10601601   000000000   0       0       1       0.2          1
10601602   000000000   0       0       1       0.4          2
10601603   000000000   0       0       1       0.6          3
```

```
10601604   000000000   0       0       1       0.8             4
10601605   000000000   0       0       1       1.0             5
10601606   000000000   0       0       1       1.5             9
10601607   000000000   0       0       1       1.8025          10
10601608   000000000   0       0       1       0.2             11
10601609   000000000   0       0       1       0.4             12
10601610   000000000   0       0       1       0.6             13
10601611   000000000   0       0       1       0.8             14
10601612   000000000   0       0       1       1.0             15
10601613   000000000   0       0       1       1.5             19
10601614   000000000   0       0       1       1.8025          20
10601615   000000000   0       0       1       0.2             21
10601616   000000000   0       0       1       0.4             22
10601617   000000000   0       0       1       0.6             23
10601618   000000000   0       0       1       0.8             24
10601619   000000000   0       0       1       1.0             25
10601620   000000000   0       0       1       1.5             29
10601621   000000000   0       0       1       1.8025          30
10601701      0           0           0         0               30
10601801      0.       10.0    10.0    0.   0.    0.   0.  1.  30
10601901      0.       10.0    10.0    0.   0.    0.   0.  1.  30
*
*************************************************************************
*                  ht str no. 61-1, 71-1, 81-1
*************************************************************************
*
10611000   3       6     2     1     0.03290   0
10611100            0               1
10611101            5               0.04038
10611201            1               5
10611301         0.0                5
10611400                            0
10611401         560.               6
10611501   061010000   0       1       1       0.158           1
10611502   071010000   10000   1       1       0.158           2
10611503   081010000   0       1       1       0.158           3
10611601   000000000   0       0       1       0.158           1
10611602   000000000   0       0       1       0.158           2
10611603   000000000   0       0       1       0.158           3
10611701      0           0           0         0               3
10611801      0.       10.0    10.0    0.   0.    0.   0.  1.  3
10611901      0.       10.0    10.0    0.   0.    0.   0.  1.  3
*
*************************************************************************
*                  ht str no. 61-2, 71-2, 81-2
*************************************************************************
*
10612000   6       6     2     1     0.02499   0
```

```
10612100          0              1
10612101          5            0.03211
10612201          1              5
10612301        0.0              5
10612400                         0
10612401        560.             6
10612501   061020000   0       1        1        0.7952          1
10612502   061030000   10000   1        1        0.900           2
10612503   071020000   0       1        1        0.7952          3
10612504   071030000   10000   1        1        0.900           4
10612505   081020000   0       1        1        0.7952          5
10612506   081030000   0       1        1        0.900           6
10612601   000000000   0       0        1        0.7952          1
10612602   000000000   0       0        1        0.900           2
10612603   000000000   0       0        1        0.7952          3
10612604   000000000   0       0        1        0.900           4
10612605   000000000   0       0        1        0.7952          5
10612606   000000000   0       0        1        0.900           6
10612701       0           0           0          0             6
10612801       0.       10.0   10.0     0.   0.    0.   0.  1.  6
10612901       0.        10.0  10.0     0.   0.    0.   0.  1.  6
*
**********************************************************************
*                ht str no. 62, 72, 82
**********************************************************************
*
10621000   3       6     2     1     0.1245     0
10621100          0              1
10621101          5            0.137
10621201          1              5
10621301        0.0              5
10621400                         0
10621401        560.             6
10621501   062010000   10000   1        1        2.16            1
10621502   072010000   10000   1        1        2.16            2
10621503   082010000   0       1        1        2.16            3
10621601   000000000   0       0        1        2.16            1
10621602   000000000   0       0        1        2.16            2
10621603   000000000   0       0        1        2.16            3
10621701       0           0           0          0             3
10621801       0.       10.0   10.0     0.   0.    0.   0.  1.  3
10621901       0.       10.0   10.0     0.   0.    0.   0.  1.  3
*
**********************************************************************
*                ht str no. 63, 73, 83
**********************************************************************
*
10631000   3       6     2     1     0.2695     0
```

```
10631100          0              1
10631101          5            0.282
10631201          1              5
10631301        0.0              5
10631400                         0
10631401       560.              6
10631501   063010000   10000   1        1        2.16          1
10631502   073010000   10000   1        1        2.16          2
10631503   083010000   0       1        1        2.16          3
10631601   000000000   0       0        1        2.16          1
10631602   000000000   0       0        1        2.16          2
10631603   000000000   0       0        1        2.16          3
10631701       0           0             0          0          3
10631801       0.       10.0    10.0    0.   0.    0.  0.   1.  3
10631901       0.       10.0    10.0    0.   0.    0.  0.   1.  3
*
*************************************************************************
*                  ht str no. 64, 65, 74, 75, 84, 85
*************************************************************************
10641000   6       6     2     1     0.088     0
10641100           0              1
10641101           5            0.0955
10641201           1              5
10641301         0.0              5
10641400                          0
10641401        550.              6
10641501   064010000   10000   1        1        0.3375        1
10641502   065010000   10000   1        1        0.8275        2
10641503   074010000   10000   1        1        0.3375        3
10641504   075010000   10000   1        1        0.8275        4
10641505   084010000   10000   1        1        0.3375        5
10641506   085010000   0       1        1        0.8275        6
10641601   000000000   0       0        1        0.3375        1
10641602   000000000   0       0        1        0.8275        2
10641603   000000000   0       0        1        0.3375        3
10641604   000000000   0       0        1        0.8275        4
10641605   000000000   0       0        1        0.3375        5
10641606   000000000   0       0        1        0.8275        6
10641701       0           0             0          0          6
10641801       0.       10.0    10.0    0.   0.    0.  0.   1.  6
10641901       0.       10.0    10.0    0.   0.    0.  0.   1.  6
*
*************************************************************************
*                  ht str no. 66, 76, 86
*************************************************************************
10661000   3       6     2     1     0.02991   0
10661100           0              1
10661101           5            0.03741
```

```
10661201          1              5
10661301       0.0               5
10661400                         0
10661401       550.              6
10661501   066010000   10000   1        1        1.9815          1
10661502   076010000   10000   1        1        1.9815          2
10661503   086010000   0       1        1        1.9815          3
10661601   000000000   0       0        1        1.9815          1
10661602   000000000   0       0        1        1.9815          2
10661603   000000000   0       0        1        1.9815          3
10661701       0           0            0          0             3
10661801       0.       10.0    10.0    0.   0.    0.  0.  1.   3
10661901       0.       10.0    10.0    0.   0.    0.  0.  1.   3
*
*********************************************************************
*                ht str no. 68, 78, 88
*********************************************************************
*
10681000    3       6     2     1     0.3265    0
10681100            0               1
10681101            5              0.3365
10681201            1               5
10681301       0.0                  5
10681400                            0
10681401       560.                 6
10681501   068010000   10000   1        1        0.4             1
10681502   078010000   10000   1        1        0.4             2
10681503   088010000   0       1        1        0.4             3
10681601   000000000   0       0        1        0.4             1
10681602   000000000   0       0        1        0.4             2
10681603   000000000   0       0        1        0.4             3
10681701       0           0            0          0             3
10681801       0.       10.0    10.0    0.   0.    0.   0.  1.  3
10681901       0.       10.0    10.0    0.   0.    0.   0.  1.  3
*
*********************************************************************
*                ht str no. 67-1/8, 77-1/8, 87-1/8
*********************************************************************
*
10671000    24      6     2     1     0.04309   0
10671100            0               1
10671101            5              0.05109
10671201            1               5
10671301       0.0                  5
10671400                            0
10671401      550.0                 6
10671501   067010000   10000   1        1        1.481           1
10671502   067040000   0       1        1        1.5             4
```

```
10671503   067050000   0       1       1       1.0             5
10671504   067060000   0       1       1       0.8             6
10671505   067070000   0       1       1       0.6             7
10671506   067080000   0       1       1       0.4             8
10671507   077010000   10000   1       1       1.481           9
10671508   077040000   0       1       1       1.5             12
10671509   077050000   0       1       1       1.0             13
10671510   077060000   0       1       1       0.8             14
10671511   077070000   0       1       1       0.6             15
10671512   077080000   0       1       1       0.4             16
10671513   087010000   10000   1       1       1.481           17
10671514   087040000   0       1       1       1.5             20
10671515   087050000   0       1       1       1.0             21
10671516   087060000   0       1       1       0.8             22
10671517   087070000   0       1       1       0.6             23
10671518   087080000   0       1       1       0.4             24
10671601   000000000   0       0       1       1.481           1
10671602   000000000   0       0       1       1.5             4
10671603   000000000   0       0       1       1.0             5
10671604   000000000   0       0       1       0.8             6
10671605   000000000   0       0       1       0.6             7
10671606   000000000   0       0       1       0.4             8
10671607   000000000   0       0       1       1.481           9
10671608   000000000   0       0       1       1.5             12
10671609   000000000   0       0       1       1.0             13
10671610   000000000   0       0       1       0.8             14
10671611   000000000   0       0       1       0.6             15
10671612   000000000   0       0       1       0.4             16
10671613   000000000   0       0       1       1.481           17
10671614   000000000   0       0       1       1.5             20
10671615   000000000   0       0       1       1.0             21
10671616   000000000   0       0       1       0.8             22
10671617   000000000   0       0       1       0.6             23
10671618   000000000   0       0       1       0.4             24
10671701      0           0              0         0            24
10671801      0.       10.0   10.0    0.   0.    0.   0.  1.   24
10671901      0.       10.0   10.0    0.   0.    0.   0.  1.   24
*
**********************************************************************
*                ht str no. 67-9, 77-9, 87-9
**********************************************************************
*
10672000    3      6      2      1     0.08034   0
10672100           0              1
10672101           5             0.08784
10672201           1              5
10672301         0.0              5
10672400                          0
```

```
10672401      557.                6
10672501  067090000  0       1       1       0.2             1
10672502  077090000  10000   1       1       0.2             2
10672503  087090000  0       1       1       0.2             3
10672601  000000000  0       0       1       0.2             1
10672602  000000000  0       0       1       0.2             2
10672603  000000000  0       0       1       0.2             3
10672701      0          0           0         0             3
10672801      0.       10.0    10.0   0.   0.   0.   0.  1.  3
10672901      0.        10.0   10.0   0.   0.   0.   0.  1.  3
*
*************************************************************************
*  pressurizer heat structures
*************************************************************************
*
*************************************************************************
*                ht str no. 91-1
*************************************************************************
10911000   1      6     2     1     0.08093   0
10911100          0             1
10911101          5            0.09593
10911201       1              5
10911301       0.0              5
10911400                        0
10911401      563.              6
10911501  091010000  0       1       1       0.105           1
10911601  000000000  0       0       1       0.105           1
10911701      0          0           0         0             1
10911801      0.       10.0    10.0   0.   0.   0.   0.  1.  1
10911901      0.        10.0   10.0   0.   0.   0.   0.  1.  1
*
*************************************************************************
*                ht str no. 91-2
*************************************************************************
10912000   1      6     2     1     0.09974   0
10912100          0             1
10912101          5            0.11474
10912201       1              5
10912301       0.0              5
10912400                        0
10912401      563.              6
10912501  091020000  0       1       1       0.892           1
10912601  000000000  0       0       1       0.892           1
10912701      0          0           0         0             1
10912801      0.       10.0    10.0   0.   0.   0.   0.  1.  1
10912901      0.        10.0   10.0   0.   0.   0.   0.  1.  1
*
*************************************************************************
```

```
*                  ht str no. 91-3
**********************************************************************
10913000    2       6     2     1     0.10499   0
10913100            0             1
10913101            5             0.11999
10913201         1                5
10913301         0.0                5
10913400                            0
10913401        563.                6
10913501   091030000   0        1        1        5.4145          2
10913601   000000000   0        0        1        5.4145          2
10913701       0            0             0          0             2
10913801       0.        10.0    10.0    0.   0.    0.   0.  1.  2
10913901       0.         10.0   10.0    0.   0.    0.   0.  1.  2
*
**********************************************************************
*                  ht str no. 91-4
**********************************************************************
10914000    1       6     2     1     0.08573   0
10914100            0             1
10914101            5             0.10073
10914201         1                5
10914301         0.0                5
10914400                            0
10914401        563.                6
10914501   091050000   0        1        1        0.105           1
10914601   000000000   0        0        1        0.105           1
10914701       0            0             0          0             1
10914801       0.        10.0    10.0    0.   0.    0.   0.  1.  1
10914901       0.         10.0   10.0    0.   0.    0.   0.  1.  1
*
**********************************************************************
*                  ht str no. 90
**********************************************************************
*
10901000    3       6     2     1     0.02046   0
10901100            0             1
10901101            5             0.02916
10901201            1             5
10901301         0.0                5
10901400                            0
10901401        563.                6
10901501   090010000   0        1        1        0.850           1
10901502   090020000   0        1        1        6.256           2
10901503   090030000   0        1        1        2.690           3
10901601   000000000   0        0        1        0.850           1
10901602   000000000   0        0        1        6.256           2
10901603   000000000   0        0        1        2.690           3
```

```
10901701      0          0          0        0         3
10901801      0.        10.0    10.0   0.   0.   0.   0. 1.  3
10901901      0.        10.0    10.0   0.   0.   0.   0. 1.  3
*
*******************************************************************
*        ht str no. 91-5   prizer htrs   ht struct
*******************************************************************
10915000    2      3     2     1      0.0      0
10915100           0             1
10915101           2             0.00525
10915201           1             2
10915301       1.0               2
10915400                         0
10915401      563.               3
10915501   0          0      0        0         0.0         2
10915601   91010000   10000   1       1       0.535        2
10915701     789        0.5          0.0       0.0          2
10915801     0.  10.   10.  0.  0.  0.  0.  1. 2
10915901      0.       10.0    10.0   0.   0.    0.  0.  1.  2
*
*******************************************************************
*       power table
*******************************************************************
20200100    power    0
20200101    0.0   2.857e+6
*
********************************************************************
* rcp heat loss
********************************************************************
*
20277700   htrnrate   407
20277701   0.      159155.
*
20277800   htrnrate
20277801   0.      30315.
*
********************************************************************
*              pzr heater
********************************************************************
*
20278900   power    407
20278901   0.       1400.
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*   calculate liquid levels in pressurizer and steam generators
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
20500100   preslev    sum    1.0    4.08     1
20500101   0.0      0.105    voidf  091010000
```

```
20500102            0.892     voidf  091020000
20500103            5.4145    voidf  091030000
20500104            5.4145    voidf  091040000
20500105            0.105     voidf  091050000
*
20500400  veslev      sum     1.0    10.421   1
20500401  0.0       1.0       voidf  011010000
20500402            1.054     voidf  012010000
20500403            0.11      voidf  013010000
20500404            0.788     voidf  013020000
20500405            0.78      voidf  013030000
20500406            0.52      voidf  013040000
20500407            0.78      voidf  013050000
20500408            0.788     voidf  013060000
20500409            0.35      voidf  013070000
20500410            1.0195    voidf  099010000
20500411            0.117     voidf  015010000
20500412            2.713     voidf  016010000
20500413            0.4015    voidf  018010000
*
20500200  sgalev      sum     1.0    10.60282 1
20500201  0.0       0.2       voidf  060010000
20500202            0.4       voidf  060020000
20500203            0.6       voidf  060030000
20500204            0.8       voidf  060040000
20500205            1.0       voidf  060050000
20500206            1.5       voidf  060060000
20500207            1.5       voidf  060070000
20500208            1.5       voidf  060080000
20500209            1.5       voidf  060090000
20500210            1.8025    voidf  060100000
20500211            0.158     voidf  061010000
20500212            0.7925    voidf  061020000
20500213            0.9       voidf  061030000
20500214            2.16      voidf  062010000
20500215            0.4       voidf  068010000
*
20500300  sgblev      sum     1.0    10.61266 1
20500301  0.0       0.2       voidf  070010000
20500302            0.4       voidf  070020000
20500303            0.6       voidf  070030000
20500304            0.8       voidf  070040000
20500305            1.0       voidf  070050000
20500306            1.5       voidf  070060000
20500307            1.5       voidf  070070000
20500308            1.5       voidf  070080000
20500309            1.5       voidf  070090000
20500310            1.8025    voidf  070100000
```

```
20500311          0.158     voidf  071010000
20500312          0.7925    voidf  071020000
20500313          0.9       voidf  071030000
20500314          2.16      voidf  072010000
20500315          0.4       voidf  078010000
*
20500500  sgclev      sum     1.0    10.61266 1
20500501  0.0     0.2       voidf  080010000
20500502          0.4       voidf  080020000
20500503          0.6       voidf  080030000
20500504          0.8       voidf  080040000
20500505          1.0       voidf  080050000
20500506          1.5       voidf  080060000
20500507          1.5       voidf  080070000
20500508          1.5       voidf  080080000
20500509          1.5       voidf  080090000
20500510          1.8025    voidf  080100000
20500511          0.158     voidf  081010000
20500512          0.7925    voidf  081020000
20500513          0.9       voidf  081030000
20500514          2.16      voidf  082010000
20500515          0.4       voidf  088010000
*
20502200  sgalevd     sum     1.0    12.00412 1
20502201  0.0     1.481     voidf  067010000
20502202          1.5       voidf  067020000
20502203          1.5       voidf  067030000
20502204          1.5       voidf  067040000
20502205          1.0       voidf  067050000
20502206          0.8       voidf  067060000
20502207          0.6       voidf  067070000
20502208          0.4       voidf  067080000
20502209          0.2       voidf  067090000
20502212          1.9815    voidf  066010000
20502213          0.8275    voidf  065010000
20502214          1.6055    voidf  064010000
20502215          0.3375    voidf  063010000
20502216           1.08     voidf  062010000
20502217          0.4       voidf  068010000
*
20503300  sgblevd     sum     1.0    12.00995 1
20503301  0.0     1.481     voidf  077010000
20503302          1.5       voidf  077020000
20503303          1.5       voidf  077030000
20503304          1.5       voidf  077040000
20503305          1.0       voidf  077050000
20503306          0.8       voidf  077060000
20503307          0.6       voidf  077070000
```

```
20503308          0.4         voidf  077080000
20503309          0.2         voidf  077090000
20503312          1.9815      voidf  076010000
20503313          0.8275      voidf  075010000
20503314          1.6055      voidf  074010000
20503315          0.3375      voidf  073010000
20503316           1.08       voidf  072010000
20503317           0.4        voidf  078010000
*
20504400   sgclevd    sum      1.0    12.00995 1
20504401   0.0    1.481       voidf  087010000
20504402          1.5         voidf  087020000
20504403          1.5         voidf  087030000
20504404          1.5         voidf  087040000
20504405          1.0         voidf  087050000
20504406          0.8         voidf  087060000
20504407          0.6         voidf  087070000
20504408          0.4         voidf  087080000
20504409          0.2         voidf  087090000
20504412          1.9815      voidf  086010000
20504413          0.8275      voidf  085010000
20504414          1.6055      voidf  084010000
20504415          0.3375      voidf  083010000
20504416           1.08       voidf  082010000
20504417           0.4        voidf  088010000
*
**********************************************************************
*  primary system masses
**********************************************************************
*
20515100   sgamas1  sum    1.0     99.3376  1
20515101    0.0     0.0350607      rho 034010000
20515102            2.068400e-3    rho 034020000
20515103            4.136800e-3    rho 034030000
20515104            6.205200e-3    rho 034040000
20515105            8.273600e-3    rho 034050000
20515106            1.034200e-2    rho 034060000
20515107            1.551300e-2    rho 034070000
20515108            1.551300e-2    rho 034080000
20515109            1.551300e-2    rho 034090000
20515110            1.551300e-2    rho 034100000
20515111            7.497950e-3    rho 034110000
*
20514100   sgamas2  sum    1.0     102.5563 1
20514112    0.0     7.497950e-3    rho 034120000
20514113            1.551300e-2    rho 034130000
20514114            1.551300e-2    rho 034140000
20514115            1.551300e-2    rho 034150000
```

```
20514116            1.551300e-2   rho 034160000
20514117            1.034200e-2   rho 034170000
20514118            8.273600e-3   rho 034180000
20514119            6.205200e-3   rho 034190000
20514120            4.136800e-3   rho 034200000
20514121            2.068400e-3   rho 034210000
20514122            0.0350607     rho 034220000
*
20515200  sgbmas1   sum    1.0    99.3376  1
20515201   0.0      0.0350607     rho 044010000
20515202            2.068400e-3   rho 044020000
20515203            4.136800e-3   rho 044030000
20515204            6.205200e-3   rho 044040000
20515205            8.273600e-3   rho 044050000
20515206            1.034200e-2   rho 044060000
20515207            1.551300e-2   rho 044070000
20515208            1.551300e-2   rho 044080000
20515209            1.551300e-2   rho 044090000
20515210            1.551300e-2   rho 044100000
20515211            7.497950e-3   rho 044110000
*
20514200  sgbmas2   sum    1.0    102.5563 1
20514212   0.0      7.497950e-3   rho 044120000
20514213            1.551300e-2   rho 044130000
20514214            1.551300e-2   rho 044140000
20514215            1.551300e-2   rho 044150000
20514216            1.551300e-2   rho 044160000
20514217            1.034200e-2   rho 044170000
20514218            8.273600e-3   rho 044180000
20514219            6.205200e-3   rho 044190000
20514220            4.136800e-3   rho 044200000
20514221            2.068400e-3   rho 044210000
20514222            0.0350607     rho 044220000
*
20516100  sgcmas1   sum    1.0    99.3376  1
20516101   0.0      0.0350607     rho 054010000
20516102            2.068400e-3   rho 054020000
20516103            4.136800e-3   rho 054030000
20516104            6.205200e-3   rho 054040000
20516105            8.273600e-3   rho 054050000
20516106            1.034200e-2   rho 054060000
20516107            1.551300e-2   rho 054070000
20516108            1.551300e-2   rho 054080000
20516109            1.551300e-2   rho 054090000
20516110            1.551300e-2   rho 054100000
20516111            7.497950e-3   rho 054110000
*
20516200  sgamas2   sum    1.0    102.5563 1
```

```
20516212     0.0     7.497950e-3   rho 054120000
20516213             1.551300e-2   rho 054130000
20516214             1.551300e-2   rho 054140000
20516215             1.551300e-2   rho 054150000
20516216             1.551300e-2   rho 054160000
20516217             1.034200e-2   rho 054170000
20516218             8.273600e-3   rho 054180000
20516219             6.205200e-3   rho 054190000
20516220             4.136800e-3   rho 054200000
20516221             2.068400e-3   rho 054210000
20516222             0.0350607     rho 054220000
*
20515300  cormas     sum    1.0    407.052  1
20515301   0.0       0.15323      rho 011010000
20515302             6.20907e-2    rho 012010000
20515303             4.70800e-3    rho 013010000
20515304             3.37264e-2    rho 013020000
20515305             3.33840e-2    rho 013030000
20515306             2.22560e-2    rho 013040000
20515307             3.33840e-2    rho 013050000
20515308             3.37264e-2    rho 013060000
20515309             1.80660e-2    rho 013070000
20515310             1.56310e-3    rho 014010000
20515312             1.11975e-2    rho 014020000
20515313             1.10838e-2    rho 014030000
20515314             7.38920e-3    rho 014040000
20515315             1.10838e-2    rho 014050000
20515316             1.11975e-2    rho 014060000
20515317             4.97350e-3    rho 014070000
20515318             9.13340e-2    rho 099010000
20515319             1.02950e-2    rho 015010000
*
20515400  vesmas     sum    1.0    361.04   1
20515401   0.0       .15418       rho 016010000
20515402             8.08300e-3    rho 017010000
20515403             4.89190e-2    rho 018010000
20515404             8.92590e-2    rho 019010000
20515405             4.33233e-2    rho 020010000
20515406             3.78310e-3    rho 021010000
20515407             2.44140e-3    rho 021020000
20515408             9.69700e-4    rho 021030000
20515410             2.39771e-2    rho 022010000
20515411             2.39771e-2    rho 022020000
20515412             2.39771e-2    rho 022030000
20515413             2.39771e-2    rho 022040000
20515414             7.51150e-3    rho 022050000
20515415             1.08295e-2    rho 022060000
20515416             2.79758e-2    rho 022070000
```

```
*
20515500  hlamas     sum     1.0     34.57254 1
20515501   0.0       1.305868e-2    rho 031010000
20515502             5.46800e-3     rho 032010000
20515503             8.724194e-3    rho 033010000
20515504             1.583533e-2    rho 033020000
20515505             6.021362e-3    rho 033030000
*
20515600  hlbmas     sum     1.0     34.57254 1
20515601   0.0       1.305868e-2    rho 041010000
20515602             5.46800e-3     rho 042010000
20515603             8.724194e-3    rho 043010000
20515604             1.583533e-2    rho 043020000
20515605             6.021362e-3    rho 043030000
*
20516600  hlcmas     sum     1.0     34.57254 1
20516601   0.0       1.305868e-2    rho 051010000
20516602             5.46800e-3     rho 052010000
20516603             8.724194e-3    rho 053010000
20516604             1.583533e-2    rho 053020000
20516605             6.021362e-3    rho 053030000
*
20515700  clamas     sum     1.0     108.3605 1
20515701   0.0       4.581000e-3    rho 035010000
20515702             2.123175e-2    rho 035020000
20515703             2.430950e-2    rho 035030000
20515704             8.967000e-3    rho 035040000
20515705             2.263400e-2    rho 035050000
20515706             2.062890e-2    rho 036010000
*20515708             8.921154e-3    rho 362010000
20515709             1.14828e-2     rho 037010000
20515710             9.394024e-3    rho 037020000
20515711             5.46800e-3     rho 038010000
20515712             8.57448e-3     rho 039010000
20515713             5.860165e-3    rho 039020000
*
20515800  clbmas     sum     1.0     108.3605 1
20515801   0.0       4.581000e-3    rho 045010000
20515802             2.123175e-2    rho 045020000
20515803             2.430950e-2    rho 045030000
20515804             8.967000e-3    rho 045040000
20515805             2.263400e-2    rho 045050000
20515806           2.06277890e-2    rho 046010000
*20515808             8.921154e-3    rho 462010000
20515809             1.14828e-2     rho 047010000
20515810             9.394024e-3    rho 047020000
20515811             5.46800e-3     rho 048010000
20515812             8.57448e-3     rho 049010000
```

```
20515813            5.860165e-3   rho 049020000
*
20516800  clcmas     sum     1.0     108.3605 1
20516801   0.0      4.581000e-3   rho 055010000
20516802            2.123175e-2   rho 055020000
20516803            2.430950e-2   rho 055030000
20516804            8.967000e-3   rho 055040000
20516805            2.263400e-2   rho 055050000
20516806          2.062290e-2   rho 056010000
20516809            1.14828e-2    rho 057010000
20516810            9.394024e-3   rho 057020000
20516811            5.46800e-3    rho 058010000
20516812            8.57448e-3    rho 059010000
20516813            5.860165e-3   rho 059020000
*
20515900  prsrmas   sum     1.0     114.4755 1
20515901   0.0      1.118650e-3   rho 090010000
20515902            9.040600e-3   rho 090020000
20515903            3.863750e-3   rho 090030000
20515904            2.161600e-3   rho 091010000
20515905            2.789000e-2   rho 091020000
20515906            0.187535      rho 091030000
20515907            0.187535      rho 091040000
20515908            2.424500e-3   rho 091050000
*
20519900  totmas    sum     1.0     1802.557 1
20519901   0.0      1.0   cntrlvar 151
20519902            1.0   cntrlvar 141
20519903            1.0   cntrlvar 152
20519904            1.0   cntrlvar 142
20519905            1.0   cntrlvar 153
20519906            1.0   cntrlvar 154
20519907            1.0   cntrlvar 155
20519908            1.0   cntrlvar 156
20519909            1.0   cntrlvar 157
20519910            1.0   cntrlvar 158
20519911            1.0   cntrlvar 159
20519912            1.0   cntrlvar 161
20519913            1.0   cntrlvar 166
20519914            1.0   cntrlvar 168
20519915            1.0   cntrlvar 162
*
20533000  tvesmas   sum     1.0     768.092 1
20533001   0.0      1.0   cntrlvar 153
20533002            1.0   cntrlvar 154
*
20531700    sgasm1      sum      1.0    605.622  1
20531701      0.0       1.151e-2     rho    060010000
```

```
20531702              2.303e-2    rho   060020000
20531703              3.454e-2    rho   060030000
20531704              4.605e-2    rho   060040000
20531705              5.756e-2    rho   060050000
20531706              8.635e-2    rho   060060000
20531707              8.635e-2    rho   060070000
20531708              8.635e-2    rho   060080000
20531709              8.635e-2    rho   060090000
20531710              0.10376     rho   060100000
20531711              1.0393e-2   rho   061010000
20531712              3.861e-2    rho   061020000
20531713              4.385e-2    rho   061030000
20531714              0.59549     rho   062010000
*
20531800   sgasm2     sum     1.0   187.0125 1
20531815    0.0       0.14922     rho   063010000
20531816              0.15856     rho   064010000
20531817              8.172e-2    rho   065010000
20531818              6.336e-2    rho   066010000
20531819              8.6429e-3   rho   067010000
20531820              8.7538e-3   rho   067020000
20531821              8.7538e-3   rho   067030000
20531822              8.7538e-3   rho   067040000
20531823              5.8359e-3   rho   067050000
20531824              4.6687e-3   rho   067060000
20531825              3.5015e-3   rho   067070000
20531826              2.3343e-3   rho   067080000
20531827              4.0563e-3   rho   067090000
20531828              0.13404     rho   068010000
20531829              3.425e-2    rho   069010000
20531830              3.425e-2    rho   069020000
*
20531900   sgasmt     sum     1.0   792.635  1
20531923    0.0       1.0       cntrlvar 317
20531924              1.0       cntrlvar 318
*
20532000   sgasm1     sum     1.0   605.622  1
20532001     0.0      1.151e-2    rho   070010000
20532002              2.303e-2    rho   070020000
20532003              3.454e-2    rho   070030000
20532004              4.605e-2    rho   070040000
20532005              5.756e-2    rho   070050000
20532006              8.635e-2    rho   070060000
20532007              8.635e-2    rho   070070000
20532008              8.635e-2    rho   070080000
20532009              8.635e-2    rho   070090000
20532010              0.10376     rho   070100000
20532011              1.0393e-2   rho   071010000
```

```
20532012            3.861e-2    rho   071020000
20532013            4.385e-2    rho   071030000
20532014            0.59549     rho   072010000
*
20532100   sgasm2   sum     1.0   187.0125 1
20532101    0.0     0.14922     rho   073010000
20532102            0.15856     rho   074010000
20532103            8.172e-2    rho   075010000
20532104            6.336e-2    rho   076010000
20532105            8.6429e-3   rho   077010000
20532106            8.7538e-3   rho   077020000
20532107            8.7538e-3   rho   077030000
20532108            8.7538e-3   rho   077040000
20532109            5.8359e-3   rho   077050000
20532110            4.6687e-3   rho   077060000
20532111            3.5015e-3   rho   077070000
20532112            2.3343e-3   rho   077080000
20532113            4.0563e-3   rho   077090000
20532114            0.13404     rho   078010000
20532115            3.425e-2    rho   079010000
20532116            3.425e-2    rho   079020000
*
20532200   sgasmt   sum     1.0   792.635  1
20532201    0.0     1.0       cntrlvar 320
20532202            1.0       cntrlvar 321
*
20532300   sgasml   sum     1.0   605.622  1
20532301     0.0    1.151e-2    rho   080010000
20532302            2.303e-2    rho   080020000
20532303            3.454e-2    rho   080030000
20532304            4.605e-2    rho   080040000
20532305            5.756e-2    rho   080050000
20532306            8.635e-2    rho   080060000
20532307            8.635e-2    rho   080070000
20532308            8.635e-2    rho   080080000
20532309            8.635e-2    rho   080090000
20532310            0.10376     rho   080100000
20532311            1.0393e-2   rho   081010000
20532312            3.861e-2    rho   081020000
20532313            4.385e-2    rho   081030000
20532314            0.59549     rho   082010000
*
20532400   sgasm2   sum     1.0   187.0125 1
20532415    0.0     0.14922     rho   083010000
20532416            0.15856     rho   084010000
20532417            8.172e-2    rho   085010000
20532418            6.336e-2    rho   086010000
20532419            8.6429e-3   rho   087010000
```

```
20532420              8.7538e-3   rho   087020000
20532421              8.7538e-3   rho   087030000
20532422              8.7538e-3   rho   087040000
20532423              5.8359e-3   rho   087050000
20532424              4.6687e-3   rho   087060000
20532425              3.5015e-3   rho   087070000
20532426              2.3343e-3   rho   087080000
20532427              4.0563e-3   rho   087090000
20532428              0.13404     rho   088010000
20532429              3.425e-2    rho   089010000
20532430              3.425e-2    rho   089020000
*
20532500   sgasmt     sum     1.0   792.635  1
20532501    0.0       1.0       cntrlvar 323
20532502              1.0       cntrlvar 324
*
*********************************************************************
*         self initialization cards
*********************************************************************
*
20526200          sg1lsp       function    1.0  820. 0
20526201    time          0         4
20526300   fw1cntl    feedctl   1.0          .52514   0 3  0.0  10.0
20526301          cntrlvar 262           cntrlvar 319
20526302      50.0       * sk
20526303     mflowj   606000000       * sg1 steam out
20526304     mflowj   601000000       * sg1 fw in
20526305  2.5 10.0  4.0       *sm=maxdt  t6=1/int.gain  t5=1/prop.gain
20527200          sg2lsp       function    1.0  820. 0
20527201    time          0         4
*
20527300   fw2cntl    feedctl   1.0          .52514   0 3  0.0  10.0
20527301          cntrlvar 272           cntrlvar 322
20527302    50.0       * sk
20527303     mflowj   706000000       * sg2 steam out
20527304     mflowj   701000000       * sg2 fw in
20527305  2.5   10.0  4.0      *sm=maxdt  t6=1/int.gain  t5=1/prop.gain
*
20528200          sg3lsp       function    1.0  820. 0
20528201    time          0         4
*
20528300   fw3cntl    feedctl   1.0          .52514   0 3  0.0  10.0
20528301          cntrlvar 282           cntrlvar 325
20528302      50.0       * sk
20528303     mflowj   806000000       * sg3 steam out
20528304     mflowj   801000000       * sg3 fw in
20528305  2.5 10.0  4.0       *sm=maxdt  t6=1/int.gain  t5=1/prop.gain
*
```

```
**********************************************************************
*        pressure setpoint for single loop sg
**********************************************************************
*
20526500     sglpsp   function 1.0  6.91+6   0
20526501      time    0    2
*
20526600    stmlcntl  steamctl  -1.34e-6  .0238706  0 3  0.0  1.0
20526601      cntrlvar 265          p 068010000
20526602     1.5                        *sj
20526603      50.0      2.0             *t4=1/int.gain  t3=1/prop.gain
*
20527500     sg2psp   function 1.0  6.91+6   0
20527501      time    0    2
20527600    stm2cntl  steamctl  -1.34e-6  .0238706  0 3  0.0   1.0
*
20527601      cntrlvar 275          p 078010000
20527602     1.5                        *s
20527603       50.0     2.0             *t4=1/int.gain  t5=1/prop.gain
*
20528500     sg3psp   function 1.0  6.91+6   0
20528501      time    0    2
*
20528600    stmlcntl  steamctl  -1.34e-6  .0238706  0 3  0.0  1.0
20528601      cntrlvar 285          p 088010000
20528602     1.5                        *sj
20528603      50.0      2.0             *t4=1/int.gain  t3=1/prop.gain
*
**********************************************************************
*sgl pressure setpoint table
20200200    power    0
20200201    0.0     6.91e6
*
*sgl mass setpoint table
20200400    power    0
20200401    0.0    820.0
*
**********************************************************************
*   thermal properties
**********************************************************************
*
*thermal properties for stainless steel
*   thermal conductivity
20100100    tbl/fctn   1   1
20100101    293.     13.9
20100102    373.     15.1
20100103    473.     16.7
20100104    573.     18.3
```

```
20100105    673.    19.8
20100106    873.    23.0
20100107   1073.    26.1
*   volumetric specific heat
20100151    293.    3.58e6
20100152    373.    3.89e6
20100153    473.    4.10e6
20100154    573.    4.21e6
20100155    673.    4.26e6
20100156    873.    4.41e6
20100157   1073.    4.66e6
*thermal properties for boron nitride
20100200   tbl/fctn   2   2
*   function for thermal conductivity
20100201   293.   2000.   24.818   -0.00276  0.0  0.0  0.0  0.0  0.0
*   function for volumetric specific heat
20100251   293.   423.    1.22e6   1.4e3     0.0  0.0  0.0  0.0  0.0
20100252   423.  1173.    1.46e6   1.62e3    0.0  0.0  0.0  0.0  0.0
*
*thermal properties for inconel 600
*   thermal conductivity
20100300    tbl/fctn    1    1
20100301    323.    14.9
20100302    373.    15.6
20100303    473.    17.2
20100304    673.    20.4
20100305    873.    23.7
20100306   1073.    27.4
*   volumetric specific heat
20100351    323.    3.76e6
20100352    373.    3.86e6
20100353    473.    4.03e6
20100354    673.    4.26e6
20100355    873.    4.68e6
20100356   1073.    4.98e6
*
```

```
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*   This contains a RELAP5 model of the French experimental facility
*   BETHSY.  The intended use of the model is for simulation of BETHSY
*   test 9.1.b which studies the 2 inch cold leg break without hpsi
*   ans with delayed ultimate procedure.
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
* transient input deck of bethsy test 9.1.b
= 2 inch cold leg break : bethsy test 9.1.b
*
100    restart   transnt
101    run
102    si   si
103    9283
105    2.       4.
*
201   2500.   1.e-6   0.5     3  10   2000  1000
*
****************************************************
*            minor edit variables
****************************************************
*
301    voidg      031010000
302    voidg      039010000
303    voidg      041010000
304    voidg      049010000
305    voidg      051010000
306    voidg      059010000
307    cntrlvar      111
308    cntrlvar      112
309    cntrlvar      113
310    cntrlvar      114
311    cntrlvar      311
312    cntrlvar      100
313    cntrlvar       51
314    cntrlvar       95
315    cntrlvar       63
316    cntrlvar       96
317    cntrlvar       52
318    cntrlvar      102
319    cntrlvar      103
320    cntrlvar       97
321    cntrlvar       53
322    cntrlvar      105
323    cntrlvar      106
324    cntrlvar       98
325    cntrlvar      316
326    cntrlvar       60
```

```
327    cntrlvar     314
328    cntrlvar     500
329    cntrlvar     326
330    cntrlvar      70
331    cntrlvar     399
332    cntrlvar     501
333    cntrlvar     336
334    cntrlvar      80
335    cntrlvar     334
336    cntrlvar     502
337    cntrlvar      73
338    cntrlvar     768   * time integrated break flow
339    cntrlvar     738
340    cntrlvar     319
341    cntrlvar     323
342    cntrlvar     326
343    cntrlvar     721
344    cntrlvar     722
345    p         068010000
346    p         078010000
347    p         088010000
348    p         091050000
349    p         721010000
350    p         722010000
351    mflowj    022030000
352    cntrlvar   34
353    cntrlvar   35
354    cntrlvar   36
355    mflowj    768000000
356    mflowj    608000000
357    mflowj    708000000
358    mflowj    808000000
359    mflowj    732000000
360    mflowj    735000000
361    sathf     037010000
362    sathg     037010000
363    tempf     020010000
364    tempf     015010000
365    tempf     019010000
366    tempf     018010000
367    tempf     033010000
368    tempf     038010000
369    tempf     043010000
370    tempf     048010000
371    tempf     053010000
372    tempf     058010000
373    tempf     060010000
374    tempf     070010000
```

```
375   tempf     080010000
376   httemp    013100708
377   httemp    013100808
378   httemp    013100908
379   httemp    013101008
380   httemp    013101108
381   httemp    013101208
382   cntrlvar    901
383   pmpvel      036
384   pmpvel      046
385   pmpvel      056
386   cntrlvar    888
387   cntrlvar    818
388   cntrlvar    821
389   cntrlvar    889
390   cntrlvar     1
391   cntrlvar     2
392   cntrlvar    22
393   cntrlvar   199
394   cntrlvar    12
395   mflowj     605000000
396   cntrlvar     13
397   cntrlvar     14
398   cntrlvar     15
399   cputime      0
*
*************************************************************************
*   trips
*************************************************************************
*
407     discard
507     discard
*
501     time   0   ge   null   0   0.0 1 * cl break
502     p   91050000   lt   null   0   1.31e7   1   *scram signal
503     time   0   ge   timeof   502   17.0   1   * core power trip
504     p     91050000   lt   null   0   1.19e7   1   * si signal
505     time   0   ge   timeof   504   6.0  1 * tbn bypass & main feed off
506     time   0   ge   timeof   504   30.0  1 * aux feed on
507     time   0   ge   timeof   504   300.0  1 * pump coastdown
508     cntrlvar   901      ge   null   0  823.15   1   * opening of steam dump
509     p     91050000  gt   null   0  1.46e6 n  * accumulator isolation
510     tempf   013070000   lt   null   0   450.1   1   * transnt termination
511     p     91050000   lt   null   0   2.5e6   1   * transnt termination
512     cntrlvar   740   lt   null   0   20.0   1   * transnt termination
513     cntrlvar   22   lt   null 0 13.72   n   * auxfeed on
514     cntrlvar   33   lt   null 0 13.72   n   * auxfeed on
515     cntrlvar   44   lt   null 0 13.72   n   * auxfeed on
```

```
516     p     91050000   lt   null   0 0.91e6   1   * lpsi
*
518     time     0     lt   timeof   505   0.0   n   0.  * tbn bypass & aux off
519     p   91050000   lt   null   0   4.16e6   n * accum on
520     time    0   ge   timeof  504  1000.   1  *rcp heater reduced
*
*600     666
603     506   and   513   n   * auxfeed-a on
604     506   and   514   n   * auxfeed-b on
605     506   and   515   n   * auxfeed-c on
*
608     509   and   519   n   * accum on
*666     510   and   511   n   * transient termination
*
*******************************************************************************
*  hydrodynamic components
*******************************************************************************
*
*******************************************************************************
*    component 36 - inlet portion of single loop pump
*******************************************************************************
*
0360000  pumpa   pump
0360101   0.0    0.350  0.02062  0.0 45.518 0.232 00000
0360108  035010000   1.0936e-2  0.0  0.0  01000
0360109  037000000   1.0936e-2  0.0  0.0  01000
0360200  0     15518260.     1253919.     2449436. 0.
0360201    0   6.23355  6.51145  0.   *  3.39762
0360202    0   6.224798 6.504798 0.   *  3.397625
0360110   .118     0.    1.   1.
0360111   .118     0.    1.   1.
0360301    0       0        0        -1     0      0      1
0360302  311. 0.94578 6.3056e-2   78.   144.75  37.3  750.0  0.  0. 4.65e-2 0. 0
*
*******************************************************************************
*      bethsy pump single phase homologous curves
*******************************************************************************
*
0361100 1  1  0.0   1.3257 0.1   1.3317 0.2   1.3273 0.3   1.3135 0.4   1.2909
0361101       0.5   1.2603 0.6   1.2223 0.7   1.1780 0.75  1.1536 0.775 1.1409
0361102       0.8   1.1279 0.825 1.1146 0.85  1.1009 0.875 1.0870 0.9   1.0728
0361103       0.925 1.0583 0.95  1.0437 0.975 1.0287 0.987 1.0215 1.0   1.0135
0361200 2  1  0.0   0.5139 0.1   0.5633 0.2   0.6128 0.3   0.6622 0.4   0.7116
0361201       0.5   0.7610 0.6   0.8105 0.7   0.8599 0.75  0.8846 0.775 0.8969
0361202       0.8   0.9093 0.825 0.9216 0.85  0.9340 0.875 0.9463 0.9   0.9587
0361203       0.925 0.9710 0.95  0.9834 0.975 0.9957 0.987 1.0017 1.0   1.0081
0361300 1  2  0.0  -0.5772 0.1  -0.4471 0.2  -0.3169 0.3  -0.1868 0.4  -0.0567
0361301       0.5   0.0733 0.6   0.2035 0.7   0.3572 0.75  0.4471 0.775 0.4951
```

```
0361302       0.8   0.5450 0.825 0.5969 0.85  0.6508 0.875 0.7066 0.9   0.7643
0361303       0.925 0.8238 0.95  0.8852 0.975 0.9485 0.987 0.9795 1.0   1.0135
0361400 2  2  0.0  -0.5772 0.1  -0.4145 0.2  -0.2518 0.3  -0.0891 0.4   0.0735
0361401       0.5   0.2362 0.6   0.3989 0.7   0.5616 0.75  0.6429 0.775 0.6836
0361402       0.8   0.7243 0.825 0.7579 0.85  0.7915 0.875 0.8263 0.9   0.8611
0361403       0.925 0.8972 0.95  0.9333 0.975 0.9707 0.987 0.9886 1.0   1.0081
0361500 1  3  -1.   1.3257  0.0  1.3257
0361600 2  3  -1.   0.5139  0.0  0.5139
0361700 1  4  -1.0  1.3257 -.900 1.2801 -.800 1.2346 -.700 1.1889 -.600 1.1434
0361701       -.500 1.0978 -.400 1.0522 -.300 1.0067 -.275 0.9953 -.250 0.9839
0361702       -.225 0.9725 -.200 0.9611 -.175 0.9497 -.150 0.9383 -.125 0.9269
0361703       -.100 0.9156 -.075 0.9042 -.050 0.8928 -.025 0.8814  0.00 0.8700
0361800 2  4  -1.0  0.5139  0.00 0.5139
0361900 1  5  0.0   1.3257  1.00 1.3257
0362000 2  5  0.0   0.5139  1.00 0.5139
0362100 1  6  .0   0.8700  .025 0.8814 .050 0.8928 .075 0.9042 .100 0.9156
0362101       .125 0.9269  .150 0.9383 .175 0.9497 .200 0.9611 .225 0.9725
0362102       .250 0.9839  .275 0.9953 .300 1.0067 .400 1.0522 .500 1.0978
0362103       .600 1.1434  .700 1.1889 .800 1.2346 .900 1.2801 1.00 1.3257
0362200 2  6  0.0   0.5139  1.000 0.5139
0362300  1  7  -1.0  0.1    0.0  1.3257
0362400  2  7  -1.0  -1.5   0.0  .5139
0362500  1  8  -1.0  0.1    0.0  -.5772
0362600  2  8  -1.0  -1.5   0.0  -.5772
*
0363000    0    0.0   0.0    0.1   0.0    0.2   0.0    0.3   0.5
0363001         0.4   1.0    0.6   1.0    0.8   1.0    0.9   1.0
0363002         1.0   0.0
0363100    0    0.0   0.0    0.1   0.0    0.2   0.0    0.3   0.5
0363101         0.4   1.0    0.6   1.0    0.8   1.0    0.9   1.0
0363102         1.0   0.0
*
*.     two-phase difference tables from semiscale
*
0364100 1   1   0.0   0.00   0.1   0.83   0.2   1.09
0364101         0.5   1.02   0.6   1.015  0.7   1.01
0364102         0.9   0.94   1.0   1.00
0364200 1   2   0.0   0.00   0.1  -0.04   0.2   0.00   0.3   0.11
0364201         0.4   0.21   0.8   0.67   0.9   0.80   1.0   1.0
0364300 1   3  -1.0  -1.06  -0.9  -1.24  -0.8  -1.77
0364301        -0.7  -2.36  -0.6  -2.79  -0.5  -2.91  -0.4  -2.67
0364302        -0.25 -1.69  -0.1  -0.50   0.0   0.00
0364400 1   4  -1.0  -1.16  -0.9  -0.78  -0.8  -0.05
0364401        -0.7  -0.31  -0.6  -0.17  -0.5  -0.17
0364402        -0.35  0.00  -0.2   0.05   0.0   0.11
0364500 1   5   0.0   0.00   0.2  -0.34
0364501         0.4  -0.65   0.6  -0.95
0364502         0.8  -1.19   1.0  -1.47
```

```
0364600 1   6   0.0   0.11    0.1   0.13    0.25  0.15
0364601         0.4   0.13    0.5   0.07    0.6  -0.04    0.7  -0.23
0364602         0.8  -0.51    0.9  -0.91    1.0  -1.47
0364700 1   7   0.0   0.0     1.0   0.0
0364800 1   8   0.0   0.0     1.0   0.0
0364900 2   1   0.0   0.0     1.0   0.0
0365000 2   2   0.0   0.0     1.0   0.0
0365100 2   3   0.0   0.0     1.0   0.0
0365200 2   4   0.0   0.0     1.0   0.0
0365300 2   5   0.0   0.0     1.0   0.0
0365400 2   6   0.0   0.0     1.0   0.0
0365500 2   7   0.0   0.0     1.0   0.0
0365600 2   8   0.0   0.0     1.0   0.0
*
*******************************************************************
* pump speed controller for steady calculation
*******************************************************************
*
0366100     504
0366101     0.0          294.1
0366102     300.0        294.1
0366103     305.0        201.0
0366104     310.0        141.3
0366105     320.0        113.0
0366106     330.0         87.9
0366107     340.0         75.3
0366108     350.0         62.8
0366109     370.0         47.1
0366110     400.0         37.6
0366111     500.0         21.9
0366112     700.0         15.7
0366113     916.0         10.4
0366114    1000.0          0.0
*
*
20542400     mserr  delete  0.   0.   0.   0.   0.   0.
20542500     rcpspp delete  0.   0.   0.   0.   0.   0.
*
*******************************************************************
*    component 46 - inlet portion of single loop pump
*******************************************************************
0460000  pumpb   pump
0460101   0.0    0.350  0.02062  0.0 45.518 0.232 00000
0460108  045010000   1.0936e-2  0.0  0.0  01000
0460109  047000000   1.0936e-2  0.0  0.0  01000
0460200  0      15518260.      1253919.      2449436. 0.
0460201    0   6.23355  6.51145  0.   *  3.39762
0460202    0   6.224798 6.504798 0.   *  3.397625
```

```
0460110   .118      0.    1.   1.
0460111   .118      0.    1.   1.
0460301   36        36      36          -1       0      0       1
0460302  311. 0.94578 6.3056e-2   78.   144.75  37.3  750.0  0.  0. 4.65e-2 0. 0
*
*
0466100     504
0466101     0.0           294.1
0466102     300.0         294.1
0466103     305.0         201.0
0466104     310.0         141.3
0466105     320.0         113.0
0466106     330.0          87.9
0466107     340.0          75.3
0466108     350.0          62.8
0466109     370.0          47.1
0466110     400.0          37.6
0466111     500.0          21.9
0466112     700.0          15.7
0466113     916.0          10.4
0466114    1000.0           0.0
*
*********************************************************************
*    component 56 - inlet portion of broken loop pump
*********************************************************************
*
0560000  pumpc    pump
0560101    0.0    0.350  0.02062  0.0 45.518 0.232 00000
0560108  055010000    1.0936e-2  0.0  0.0  01000
0560109  057000000    1.0936e-2  0.0  0.0  01000
0560200  0      15518260.      1253919.      2449436. 0.
0560201    0   6.23355  6.51145  0.    *  3.39762
0560202    0   6.224798 6.504798 0.    *  3.397625
0560110   .118      0.    1.   1.
0560111   .118      0.    1.   1.
0560301   36       36      36          -1       0      0       1
0560302  311. 0.94578 6.3056-2   78.  144.75  37.3  750.0  0. 0. 4.65e-2 0. 0.
*
*
0566100     504
0566101     0.0           294.1
0566102     300.0         294.1
0566103     305.0         201.0
0566104     310.0         141.3
0566105     320.0         113.0
0566106     330.0          87.9
0566107     340.0          75.3
0566108     350.0          62.8
```

```
0566109     370.0          47.1
0566110     400.0          37.6
0566111     500.0          21.9
0566112     700.0          15.7
0566113     916.0          10.4
0566114    1000.0           0.0
*
*******************************************************************************
*                    break nodalization
*******************************************************************************
*
*7000000     breakjn     sngljun
*7000101     037010000     767000000   2.083e-5   0.   100.   01100
*7000201     1     0.     0.     0.
*
*7670000     breakpp     pipe
*7670001     2
*7670101     1.6619e-3     2
*7670301     0.7953        2
*7670601     0.0           2
*7670801     4.0e-5     0.0     2
*7671001     00     2
*7671101     01000     1
*7671201     003    15.5e6   565.0   0.  0.  0.   2
*7671300     1
*7671301     0.    0.   0.   1
*
7680000     breakvlv     valve
7680101     037010000    900000000   2.0830e-5   0.   0.   00100
7680102     0.85   1.
7680201     1     0.   0.   0.
7680300     trpvlv
7680301     501
*
9000000     containm     tmdpvol
9000101     1.0e+8 10.0   0.   0.   0.   0.
9000102     0.0     0.   00
9000200     002
9000201     0.0     0.101e6   1.0
*
*******************************************************************************
*   aux feedwater
*******************************************************************************
*
7110000     auxfeeda     tmdpvol
7110101     10.0   5.0   0.   0.   0.   0.   0.   0   00
7110200     3
7110201     0.   5.9e6   307.15
```

```
*
7120000     auxfeeda     tmdpjun
7120101     711000000   065000000   0.004
7120200     1     506    cntrlvar 13
7120201     -1.0  0.   0.   0.
7120202      0.0    0.30451   0.   0.
7120203     13.32   0.30451   0.   0.
7120204     13.42   0.22863   0.   0.
7120205     13.52   0.15275   0.   0.
7120206     13.62   0.07687   0.   0.
7120207     13.72   0.0       0.   0.
7120208     14.00   0.0       0.   0.
7120209     20.00   0.0       0.   0.
*
7130000     auxfeedb     tmdpvol
7130101     10.0   5.0   0.   0.   0.   0.   0.   0   00
7130200     3
7130201     0.   5.9e6   307.15
*
7140000     auxfeedb     tmdpjun
7140101     713000000   075000000   0.004
7140200     1     506    cntrlvar 14
7140201     -1.0  0.   0.   0.
7140202      0.0    0.30451   0.   0.
7140203     13.32   0.30451   0.   0.
7140204     13.42   0.22863   0.   0.
7140205     13.52   0.15275   0.   0.
7140206     13.62   0.07687   0.   0.
7140207     13.72   0.0       0.   0.
7140208     14.00   0.0       0.   0.
7140209     20.00   0.0       0.   0.
*
7150000     auxfeedc     tmdpvol
7150101     10.0   5.0   0.   0.   0.   0.   0.   0   00
7150200     3
7150201     0.   5.9e6   307.15
*
7160000     auxfeedc     tmdpjun
7160101     715000000   085000000   0.004
7160200     1     605    cntrlvar 15
7160201     -1.0  0.   0.   0.
7160202      0.0    0.30451   0.   0.
7160203     13.32   0.30451   0.   0.
7160204     13.42   0.22863   0.   0.
7160205     13.52   0.15275   0.   0.
7160206     13.62   0.07687   0.   0.
7160207     13.72   0.0       0.   0.
7160208     14.00   0.0       0.   0.
```

```
7160209     20.00   0.0       0.   0.
*
*************************************************************************
*    accumulator injection
*************************************************************************
*
7210000     accub     accum
7210101     0.0       8.376  0.423  0.0   90.0   8.376   3.3e-5   0.  00
7210200     4.18e6     290.15
7211101     048000000   1.14e-3   19.0    19.0   0
7212200     0.2562  0.0   21.0   9.780   0.00927   0   0    0    608
*
7220000     accuc     accum
7220101     0.0       8.376  0.423  0.0   90.0   8.376   3.3e-5   0.  00
7220200     4.18e6     290.15
7221101     058000000   1.14e-3   19.0    19.0    0
7222200     0.2562  0.0   21.75  9.780   0.00927   0   0    0    608
*
*
*************************************************************************
*     component 48 - single loop accumulator nozzle
*************************************************************************
*
0480000     accnoza     branch
0480001     3     0
0480101     1.0936e-2   0.5   0.0   0.0   0.0   0.0   4.57e-5   .118   00000
0480200     003     15737388.    561.3
0481101     047010000   048000000   1.0936e-2   0.0   0.0   01000
0482101     048010000   049000000   1.0936e-2   0.0   0.0   01000
0483101     733010000   048000000   1.0936e-2   0.0   0.0   01000
0481201     6.2291    6.2291  0.0
0482201     6.2291    6.2291  0.0
0483201     0.0       0.0     0.0
0481110     0.118   0.0   1.0   1.0
0482110     0.118   0.0   1.0   1.0
0483110     0.118   0.0   1.0   1.0
*
*************************************************************************
*     component 58 - single loop accumulator nozzle
*************************************************************************
*
0580000     accnozc     branch
0580001     3     0
0580101     1.0936e-2   0.5   0.0   0.0   0.0   0.0   4.57e-5   .118   00000
0580200     003     15737388.    561.3
0581101     057010000   058000000   1.0936e-2   0.0   0.0   01000
0582101     058010000   059000000   1.0936e-2   0.0   0.0   01000
0583101     736010000   058000000   1.0936e-2   0.0   0.0   01000
```

```
0581201     6.2291    6.2291  0.0
0582201     6.2291    6.2291  0.0
0583201     0.0       0.0     0.0
0581110     0.118   0.0   1.0   1.0
0582110     0.118   0.0   1.0   1.0
0583110     0.118   0.0   1.0   1.0
*
*******************************************************************************
*    low pressure safety injection
*******************************************************************************
*
7310000     lpsib     tmdpvol
7310101     4.375   10.   0.   0.   0.   0.  0.   0.   00
7310200     3
7310201     0.0   1.013e5     307.15
*
7320000     lpsib     tmdpjun
7320101     731000000   733000000   2.55e03
7320200     1   516   p   091050000
7320201     -1.0     0.     0.     0.
7320202     0.          1.9749   0.   0.
7320203     0.1e6       1.8633   0.   0.
7320204     0.2e6       1.7445   0.   0.
7320205     0.3e6       1.6169   0.   0.
7320206     0.4e6       1.4785   0.   0.
7320207     0.5e6       1.3256   0.   0.
7320208     0.6e6       1.1527   0.   0.
7320209     0.7e6       0.9487   0.   0.
7320210     0.8e6       0.6866   0.   0.
7320211     0.9e6       0.2070   0.   0.
7320212     0.91e6      0.0      0.   0.
*
7330000     lpsijun     snglvol
7330101     2.55e-3   16.0   0.   0.   0.   0.   3.33e-5
7330102     0.0   00
7330200     0     15738000.0   1253920. 2442260.   0.0
*
7340000     lpsic     tmdpvol
7340101     4.375   10.   0.   0.   0.   0.  0.   0.   00
7340200     3
7340201     0.0   1.013e5     307.15
*
7350000     lpsib     tmdpjun
7350101     734000000   736000000   2.55e03
7350200     1   516   p   091050000
7350201     -1.0     0.     0.     0.
7350202     0.          1.9749   0.   0.
7350203     0.1e6       1.8633   0.   0.
```

```
7350204     0.2e6      1.7445  0.   0.
7350205     0.3e6      1.6169  0.   0.
7350206     0.4e6      1.4785  0.   0.
7350207     0.5e6      1.3256  0.   0.
7350208     0.6e6      1.1527  0.   0.
7350209     0.7e6      0.9487  0.   0.
7350210     0.8e6      0.6866  0.   0.
7350211     0.9e6      0.2070  0.   0.
7350212     0.91e6     0.0     0.   0.
*
7360000     lpsijun    snglvol
7360101     2.55e-3  16.0  0.   0.   0.   0.   3.33e-5
7360102     0.0   00
7360200     0     15738000.0   1253920. 2442260.   0.0
*
*******************************************************************
*    description of primary system components
*******************************************************************
*
******************************************************************
* component 93   trip valve for pzr steady  state
******************************************************************
*
0930000     pzrvlv     delete
*
******************************************************************
* component 94  time dependent volume for pzr stp
******************************************************************
*
0940000   pzr-tmdp    delete
*
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*   steam generator secondary system components
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*
20526200     sg1lsp   delete   0.0   0. 0.  0.  0.  0.0
20526300     fw1cntl  delete   0. 0. 0. 0. 0. 0.
20527200     sg2lsp   delete    0.  0.  0.  0.  0.0   0.0
20527300     fw2cntl  delete   0. 0. 0. 0. 0. 0.
20528200     sg3lsp   delete    0.  0.  0.  0.  0.0   0.0
20528300     fw3cntl  delete   0. 0. 0. 0. 0. 0.
20526500     sg1psp   delete    0.  0.  0.  0.  0.0   0.0
20526600    stm1cntl  delete   0. 0. 0. 0. 0. 0.
20527500     sg2psp   delete    0.  0.  0.  0.  0.0   0.0
20527600    stm2cntl  delete   0. 0. 0. 0. 0. 0.
20528500     sg3psp   delete    0.  0.  0.  0.  0.0   0.0
20528600    stm3cntl  delete   0. 0. 0. 0. 0. 0.
```

```
*
*******************************************************************
*    component 609 - feedwater source
*******************************************************************
*
6090000   feedwtr  tmdpvol
6090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
6090200   103   0
6090201    0.0   6.910e6   491.1
*
*******************************************************************
*    component 601 - feedwater junction
*******************************************************************
*
6010000                "fedwtr"              tmdpjun
6010101   609000000      065000000      0.0
6010200      1            518
6010201   -1.0      0.0      0.0      0.0
6010202    0.0      0.52514   0.0   0.0
6010203   100.0    0.52514   0.0   0.0
*
*******************************************************************
*    component 606 - steamline outlet
*******************************************************************
*
6060000              "trb st n"            valve
6060101   069010000      607000000    4.94e-5    0.0        0.0       00000
6060201    1                 0.           .52514        0
6060300                    trpvlv
6060301    518
*
*******************************************************************
*    component 607 - steamline sink volume
*******************************************************************
*
6070000   stmsink   tmdpvol
6070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
6070200   102   0
6070201   0.0   0.101e6   1.0
*
*******************************************************************
*    component 648 - steam bypass
*******************************************************************
*
6480000   stmbypas   tmdpjun
6480101   069010000   607000000   1.14e-3
6480200   1   505   p   68010000
6480201   -1.0       0.0      0.0      0.0
```

```
6480202   7.03e+6    0.0      0.0      0.0
6480203   7.05e+6    0.0      0.5      0.0
6480204   7.06e+6    0.0      1.0      0.0
*
*******************************************************************************
*    component 610 -  steam dump valve
*******************************************************************************
*
6100000   stmdump   tmdpjun
6100101   069010000   607000000   1.8506e-4
6100200   1     508   p   68010000
6100201   -1.0   0.0   0.0   0.0
6100202   0.1e6   0.0   0.0   0.0
6100203   7.03e6   0.0   0.55555   0.0
6100204   8.0e6   0.0   0.95238   0.0
*
*******************************************************************************
*   component 709 - feedwater source
*******************************************************************************
*
7090000   feedwtr  tmdpvol
7090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
7090200   103   0
7090201    0.0   6.910e6   491.1
*
*******************************************************************************
*    component 701 - feedwater junction
*******************************************************************************
*
7010000                "fedwtr"              tmdpjun
7010101   709000000      075000000      0.0
7010200      1           518
7010201   -1.0      0.0      0.0      0.0
7010202    0.0      0.52514   0.0   0.0
7010203   100.0     0.52514   0.0   0.0
*
*******************************************************************************
*    component 706 - steamline outlet
*******************************************************************************
*
7060000             "trb st n"            valve
7060101   079010000      707000000    4.94e-5    0.0        0.0       00000
7060201     1                 0.           .52514       0
7060300                    trpvlv
7060301       518
*
*******************************************************************************
*    component 707 - steamline sink volume
```

```
*******************************************************************
*
7070000   stmsink   tmdpvol
7070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
7070200   102   0
7070201   0.0   0.101e6   1.0
*
*******************************************************************
*    component 748 - steam bypass
*******************************************************************
*
7480000   stmbypas   tmdpjun
7480101   079010000   707000000   1.14e-3
7480200   1   505   p   78010000
7480201   -1.0       0.0      0.0      0.0
7480202   7.03e+6    0.0      0.0      0.0
7480203   7.05e+6    0.0      0.5      0.0
7480204   7.06e+6    0.0      1.0      0.0
*
*******************************************************************
*    component 710 -  steam dump valve
*******************************************************************
*
7100000   stmdump   tmdpjun
7100101   079010000   707000000   1.8506e-4
7100200   1     508   p   78010000
7100201   -1.0   0.0   0.0   0.0
7100202   0.1e6   0.0   0.0   0.0
7100203   7.03e6   0.0   0.55555   0.0
7100204   8.0e6   0.0   0.95238   0.0
*
*******************************************************************
*    component 809 - feedwater source
*******************************************************************
*
8090000   feedwtr  tmdpvol
8090101 1.0e6   1.0   0.0  0.0   0.0   0.0   0.0  0.0   11
8090200   103   0
8090201    0.0   6.910e6   499.1
*
*******************************************************************
*    component 801 - feedwater junction
*******************************************************************
*
8010000              "fedwtr"            tmdpjun
8010101   809000000      085000000      0.0
8010200      1           518
8010201   -1.0      0.0      0.0      0.0
```

```
8010202    0.0      0.52514    0.0    0.0
8010203   100.0     0.52514    0.0    0.0
*
*******************************************************************
*    component 806 - steamline outlet
*******************************************************************
*
8060000              "trb st n"            valve
8060101   089010000      807000000     4.94e-5    0.0        0.0       00000
8060201     1                 0.           .52514        0
8060300                     trpvlv
8060301       518
*
*******************************************************************
*    component 807 - steamline sink volume
*******************************************************************
*
8070000   stmsink   tmdpvol
8070101   1.0e6   1.0   0.0   0.0   0.0   0.0   0.0   0.0   10
8070200   102   0
8070201   0.0   0.101e6   1.0
*
*******************************************************************
*    component 848 - steam bypass
*******************************************************************
*
8480000   stmbypas   tmdpjun
8480101   089010000   807000000   1.14e-3
8480200   1   505   p   88010000
8480201   -1.0        0.0      0.0      0.0
8480202   7.03e+6     0.0      0.0      0.0
8480203   7.05e+6     0.0      0.5      0.0
8480204   7.06e+6     0.0      1.0      0.0
*
*******************************************************************
*    component 810 -  steam dump valve
*******************************************************************
*
8100000   stmdump   tmdpjun
8100101   089010000   807000000   1.8506e-4
8100200   1     508   p   88010000
8100201   -1.0   0.0   0.0   0.0
8100202   0.1e6   0.0   0.0   0.0
8100203   7.03e6   0.0   0.55555   0.0
8100204   8.0e6   0.0   0.95238   0.0
*
*******************************************************************
*        power table
```

```
*****************************************************************
20200100    power   502
20200101   -1.0   2.857e6
20200102    0.0   2.857e6 17.0   2.857e6 17.6   2.720e6 19.0   2.578e6
20200103   21.5   2.434e6 24.0   2.290e6 26.8   2.148e6 29.7   2.005e6
20200104   32.6   1.862e6 36.0   1.750e6 44.0   1.550e6 52.0   1.385e6
20200105   63.0   1.265e6 74.0   1.170e6 84.0   1.110e6 94.0   1.050e6
20200106  104.0   0.990e6 123.0   0.964e6 153.0  0.906e6 198.0   0.854e6
20200107  273.0   0.812e6 373.0   0.750e6 423.0   0.726e6  523.0 0.706e6
20200108  623.0   0.680e6 723.0   0.662e6 823.0   0.647e6 923.0   0.629e6
20200109  1923.0   0.510e6 3123.0   0.439e6 5123.0   0.380e6
20200110  7123.0   0.340e6 9123.0   0.324e6 18123.0   0.271e6
*
*****************************************************************
*  delete rcp and pzr heaters
*****************************************************************
20277700     htrnrate   520
20277701     -1.0       159155.
20277702      0.0        0.0
*
20277800     htrnrate
20277801     0.0        51556.1
*
20278900     power      501
20278901     0.         0.
*
*****************************************************************
*                    control variables
*****************************************************************
*
*calculate time-integrated break mass flow
*
20576800     breakfl   integral   1.0   0.0   1
20576801     mflowj     768000000
*
* calculate time-integrated lpsi flow
*
20573200     lpsib   integral   1.0   0.0   1
20573201     mflowj     732000000
*
20573500     lpsic   integral   1.0   0.0   1
20573501     mflowj     735000000
*
20573800     lpsisum   sum   1.0   0.0   1
20573801     0.0   1.0   cntrlvar   732
20573802           1.0   cntrlvar   735
*
20574000     smargin   sum   1.0   0.0   1
```

```
20574001     0.0   1.0  sattemp   039010000
20574002          -1.0   tempf    039010000
*
20531700    sgasm1      sum     1.0   605.622  1
20531701      0.0       1.151e-2    rho   060010000
20531702                2.303e-2    rho   060020000
20531703                3.454e-2    rho   060030000
20531704                4.605e-2    rho   060040000
20531705                5.756e-2    rho   060050000
20531706                8.635e-2    rho   060060000
20531707                8.635e-2    rho   060070000
20531708                8.635e-2    rho   060080000
20531709                8.635e-2    rho   060090000
20531710                0.10376     rho   060100000
20531711                1.0393e-2   rho   061010000
20531712                3.861e-2    rho   061020000
20531713                4.385e-2    rho   061030000
20531714                0.59549     rho   062010000
*
20531800    sgasm2      sum     1.0   187.0125 1
20531801     0.0        0.14922     rho   063010000
20531802                0.15856     rho   064010000
20531803                8.172e-2    rho   065010000
20531804                6.336e-2    rho   066010000
20531805                8.6429e-3   rho   067010000
20531806                8.7538e-3   rho   067020000
20531807                8.7538e-3   rho   067030000
20531808                8.7538e-3   rho   067040000
20531809                5.8359e-3   rho   067050000
20531810                4.6687e-3   rho   067060000
20531811                3.5015e-3   rho   067070000
20531812                2.3343e-3   rho   067080000
20531813                4.0563e-3   rho   067090000
20531814                0.13404     rho   068010000
20531815                3.425e-2    rho   069010000
20531816                3.425e-2    rho   069020000
*
20531900    sgasmt      sum     1.0   792.635  1
20531901     0.0        1.0       cntrlvar 317
20531902                1.0       cntrlvar 318
*
20532000    sgbsm1      sum     1.0   605.622  1
20532001      0.0       1.151e-2    rho   070010000
20532002                2.303e-2    rho   070020000
20532003                3.454e-2    rho   070030000
20532004                4.605e-2    rho   070040000
20532005                5.756e-2    rho   070050000
20532006                8.635e-2    rho   070060000
```

```
20532007              8.635e-2    rho   070070000
20532008              8.635e-2    rho   070080000
20532009              8.635e-2    rho   070090000
20532010              0.10376     rho   070100000
20532011              1.0393e-2   rho   071010000
20532012              3.861e-2    rho   071020000
20532013              4.385e-2    rho   071030000
20532014              0.59549     rho   072010000
*
20532100    sgbsm2    sum     1.0   187.0125 1
20532101     0.0      0.14922     rho   073010000
20532102              0.15856     rho   074010000
20532103              8.172e-2    rho   075010000
20532104              6.336e-2    rho   076010000
20532105              8.6429e-3   rho   077010000
20532106              8.7538e-3   rho   077020000
20532107              8.7538e-3   rho   077030000
20532108              8.7538e-3   rho   077040000
20532109              5.8359e-3   rho   077050000
20532110              4.6687e-3   rho   077060000
20532111              3.5015e-3   rho   077070000
20532112              2.3343e-3   rho   077080000
20532113              4.0563e-3   rho   077090000
20532114              0.13404     rho   078010000
20532115              3.425e-2    rho   079010000
20532116              3.425e-2    rho   079020000
*
20532200    sgbsmt    sum     1.0   792.635  1
20532201     0.0      1.0       cntrlvar 320
20532202              1.0       cntrlvar 321
*
20532300    sgcsm1    sum     1.0   605.622  1
20532301      0.0     1.151e-2    rho   080010000
20532302              2.303e-2    rho   080020000
20532303              3.454e-2    rho   080030000
20532304              4.605e-2    rho   080040000
20532305              5.756e-2    rho   080050000
20532306              8.635e-2    rho   080060000
20532307              8.635e-2    rho   080070000
20532308              8.635e-2    rho   080080000
20532309              8.635e-2    rho   080090000
20532310              0.10376     rho   080100000
20532311              1.0393e-2   rho   081010000
20532312              3.861e-2    rho   081020000
20532313              4.385e-2    rho   081030000
20532314              0.59549     rho   082010000
*
20532400    sgcsm2    sum     1.0   187.0125 1
```

```
20532401     0.0        0.14922      rho    083010000
20532402                0.15856      rho    084010000
20532403                8.172e-2     rho    085010000
20532404                6.336e-2     rho    086010000
20532405                8.6429e-3    rho    087010000
20532406                8.7538e-3    rho    087020000
20532407                8.7538e-3    rho    087030000
20532408                8.7538e-3    rho    087040000
20532409                5.8359e-3    rho    087050000
20532410                4.6687e-3    rho    087060000
20532411                3.5015e-3    rho    087070000
20532412                2.3343e-3    rho    087080000
20532413                4.0563e-3    rho    087090000
20532414                0.13404      rho    088010000
20532415                3.425e-2     rho    089010000
20532416                3.425e-2     rho    089020000
*
20532500    sgcsmt      sum      1.0   792.635  1
20532501     0.0        1.0        cntrlvar 323
20532502                1.0        cntrlvar 324
*
*mass inventory of accumulator b
*
20572100   accmass   mult   1.0   0.   1
20572101   rhof   721010000   acvliq   721
*
20572200   accmasc   mult   1.0   0.0   1
20572201   rhof   722010000   acvliq   722
*
* core collapsed level
*
20581800     corelvl   sum   1.0   0.0   1
20581801     0.0   0.11     voidf   013010000
20581802           0.788    voidf   013020000
20581803           0.78     voidf   013030000
20581804           0.52     voidf   013040000
20581805           0.78     voidf   013050000
20581806           0.788    voidf   013060000
20581807           0.35     voidf   013070000
20581808           1.054    voidf   012010000
20581809           0.600    voidf   011010000
*
* run statistics
*
20581900     oldtime   sum   1.0   0.0   0
20581901     0.0   1.0   cntrlvar   820
20582000     newtime   sum   1.0   0.0   0
20582001     0.0   1.0   time    0
```

```
20582100     timstep   sum   1.0   0.0   0.0
20582101     0       -1.     cntrlvar  819
20582102             1.      cntrlvar  820
*
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=
*    calculate liquid levels in pressurizer and steam generators
*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*
20500100   preslev    sum     1.0     4.08      1
20500101   0.0       0.105    voidf   091010000
20500102             0.892    voidf   091020000
20500103             5.4145   voidf   091030000
20500104             5.4145   voidf   091040000
20500105             0.105    voidf   091050000
*
20500400   veslev     sum     1.0     10.421    1
20500401   0.0       1.0      voidf   011010000
20500402             1.054    voidf   012010000
20500403             0.11     voidf   013010000
20500404             0.788    voidf   013020000
20500405             0.78     voidf   013030000
20500406             0.52     voidf   013040000
20500407             0.78     voidf   013050000
20500408             0.788    voidf   013060000
20500409             0.35     voidf   013070000
20500410             1.0195   voidf   099010000
20500411             0.117    voidf   015010000
20500412             2.713    voidf   016010000
20500413             0.4015   voidf   018010000
*
20500200   sgalev     sum     1.0     10.60282 1
20500201   0.0       0.2      voidf   060010000
20500202             0.4      voidf   060020000
20500203             0.6      voidf   060030000
20500204             0.8      voidf   060040000
20500205             1.0      voidf   060050000
20500206             1.5      voidf   060060000
20500207             1.5      voidf   060070000
20500208             1.5      voidf   060080000
20500209             1.5      voidf   060090000
20500210             1.8025   voidf   060100000
20500211             0.158    voidf   061010000
20500212             0.7925   voidf   061020000
20500213             0.9      voidf   061030000
20500214             2.16     voidf   062010000
20500215             0.4      voidf   068010000
*
20500300   sgblev     sum     1.0     10.61266 1
20500301   0.0       0.2      voidf   070010000
```

```
20500302            0.4         voidf  070020000
20500303            0.6         voidf  070030000
20500304            0.8         voidf  070040000
20500305            1.0         voidf  070050000
20500306            1.5         voidf  070060000
20500307            1.5         voidf  070070000
20500308            1.5         voidf  070080000
20500309            1.5         voidf  070090000
20500310            1.8025      voidf  070100000
20500311            0.158       voidf  071010000
20500312            0.7925      voidf  071020000
20500313            0.9         voidf  071030000
20500314            2.16        voidf  072010000
20500315            0.4         voidf  078010000
*
20500500  sgclev      sum       1.0    10.61266 1
20500501  0.0       0.2         voidf  080010000
20500502            0.4         voidf  080020000
20500503            0.6         voidf  080030000
20500504            0.8         voidf  080040000
20500505            1.0         voidf  080050000
20500506            1.5         voidf  080060000
20500507            1.5         voidf  080070000
20500508            1.5         voidf  080080000
20500509            1.5         voidf  080090000
20500510            1.8025      voidf  080100000
20500511            0.158       voidf  081010000
20500512            0.7925      voidf  081020000
20500513            0.9         voidf  081030000
20500514            2.16        voidf  082010000
20500515            0.4         voidf  088010000
*
20502200  sgalevd     sum       1.0    12.00412 1
20502201  0.0     1.481         voidf  067010000
20502202            1.5         voidf  067020000
20502203            1.5         voidf  067030000
20502204            1.5         voidf  067040000
20502205            1.0         voidf  067050000
20502206            0.8         voidf  067060000
20502207            0.6         voidf  067070000
20502208            0.4         voidf  067080000
20502209            0.2         voidf  067090000
20502212            1.9815      voidf  066010000
20502213            0.8275      voidf  065010000
20502214            1.6055      voidf  064010000
20502215            0.3375      voidf  063010000
20502216             2.16       voidf  062010000
20502217            0.4         voidf  068010000
```

```
*
20503300   sgblevd    sum     1.0     12.00995 1
20503301   0.0     1.481      voidf   077010000
20503302           1.5        voidf   077020000
20503303           1.5        voidf   077030000
20503304           1.5        voidf   077040000
20503305           1.0        voidf   077050000
20503306           0.8        voidf   077060000
20503307           0.6        voidf   077070000
20503308           0.4        voidf   077080000
20503309           0.2        voidf   077090000
20503312           1.9815     voidf   076010000
20503313           0.8275     voidf   075010000
20503314           1.6055     voidf   074010000
20503315           0.3375     voidf   073010000
20503316            2.16      voidf   072010000
20503317            0.4       voidf   078010000
*
*
20504400   sgclevd    sum     1.0     12.00995 1
20504401   0.0     1.481      voidf   087010000
20504402           1.5        voidf   087020000
20504403           1.5        voidf   087030000
20504404           1.5        voidf   087040000
20504405           1.0        voidf   087050000
20504406           0.8        voidf   087060000
20504407           0.6        voidf   087070000
20504408           0.4        voidf   087080000
20504409           0.2        voidf   087090000
20504412           1.9815     voidf   086010000
20504413           0.8275     voidf   085010000
20504414           1.6055     voidf   084010000
20504415           0.3375     voidf   083010000
20504416            2.16      voidf   082010000
20504417            0.4       voidf   088010000
*
**********************************************************************
*  calculate pressure differences
**********************************************************************
20500600    p02       sum     1.0     15694560. 1
20500601   0.0      1.0        p       013070000
20500602           -0.441      rho     013070000
*
20504100  dp461f     sum    1.e-3    260.256  1
20504101   0.0       1.0      p 060010000
20504102            -1.0      p 060060000
20504103            +0.49     rho 060010000
20504104           +5.635     rho 060060000
```

```
*
20504200  dp561f     sum    1.e-3    260.3635 1
20504201   0.0       1.0      p 070010000
20504202            -1.0      p 070060000
20504203            +0.49     rho 070010000
20504204           +5.635     rho 070060000
*
20504300  dp661f     sum    1.e-3    260.3635 1
20504301   0.0       1.0      p 080010000
20504302            -1.0      p 080060000
20504303            +0.49     rho 080010000
20504304           +5.635     rho 080060000
*
20505100    dp1       sum     1.e-3     13.9222  1
20505101    0.0     1.0    p 039010000
20505102          -1.0    p 031010000
*
20505200    dp2       sum     1.e-3     13.92278 1
20505201    0.0     1.0    p 049010000
20505202          -1.0    p 041010000
*
20505300    dp3       sum     1.e-3     13.92278 1
20505301    0.0     1.0    p 059010000
20505302          -1.0    p 051010000
*
20505900  dp11v       sum     1.e-3     102.8206 1
20505901    0.0     1.0    p 033010000
20505902          -1.0    p 033030000
20505903        -1.9213 rho 033030000
*
20506000    dp41      sum     1.e-3     70.6971   1
20506001    0.0     1.0    p 033030000
20506002          -1.0    p 034010000
20506003         1.9213  rho 033030000
20506004         2.189   rho 034010000
*
20506100   d11v41     sum     1.e-3 173.5176   1
20506101    0.0     1.0    cntrlvar 59
20506102          +1.0    cntrlvar 60
*
20506200    dp44      sum     1.e-3     77.5905  1
20506201    0.0     1.0    p 035010000
20506202          -1.0    p 034220000
20506203        +2.8204 rho 035010000
20506204        +2.189  rho 034220000
*
20506300    dp12vg    sum     1.e-3     287.572  1
20506301    0.0     1.0    p 035040000
```

```
20506302          -1.0    p 035010000
20506303        -.579     rho 035040000
20506304        -2.8204   rho 035010000
*
20506400   d4412vg   sum   1.e-3  365.162    1
20506401    0.0     1.0    cntrlvar 62
20506402           +1.0    cntrlvar 63
*
20506800    dp0r3  sum    1.e-3   497.097   1
20506801    0.0     1.0      p 011010000
20506802           -1.0      p 031010000
20506803          +.981      rho 011010000
*
20507100   dp0r2   sum    1.e-3   218.743  1
20507101   0.0      1.0      p 031010000
20507102           -1.0      p 018010000
20507104          +1.9545   rho 018010000
*
20533100   dp0r2a3 sum    1.e-3   7.1584   1
20533101   0.0      1.0   cntrlvar 68
20533102           1.0   cntrlvar 71
*
20507300   dpp1     sum    1.e-3   269.995  1
20507301   0.0      1.0      p 091020000
20507302           -1.0      p 091050000
20507303          -.491      rho 091020000
20507304           .716      rho 091050000
*
20507400   dpp2     sum    1.e-3   231.885  1
20507401   0.0      1.0      p 091030000
20507402           -1.0      p 091040000
20507403          +25.182   rho 091030000
20507404          +19.384   rho 091040000
*
20507500   dpp3     sum    1.e-3   264.0964 1
20507501   0.0      1.0      p 032010000
20507502           -1.0      p 091020000
20507503          +.491      rho 091020000
*
20509100  dp4r1     sum    1.e-3   761.492  1
20509101   0.0      1.0      p 067080000
20509102           -1.0      p 062010000
20509103          +0.981     rho 067080000
20509104          +9.614     rho 062010000
*
20509300  dp5r1     sum    1.e-3   762.19   1
20509301   0.0      1.0      p 077080000
20509302           -1.0      p 072010000
```

```
20509303          +0.981      rho 077080000
20509304          +9.614      rho 072010000
*
20509500  dp12p      sum    1.e-3    46.7045    1
20509501   0.0        1.0      p 035050000
20509502             -1.0      p 037010000
20509503          -7.794      rho 035050000
*
20510000  dp0r1      sum    1.e-3    717.201    1
20510001   0.0        1.0      p 011010000
20510002             -1.0      p 018010000
20510003            0.981      rho 011010000
20510004            2.148      rho 018010000
*
*************************************************************************
*
20511100    dp0200    sum     1.e-3     0.         1
20511101    0.0     1.0    p 011010000
20511102           -1.0    p 013070000
20511103            1.715    rho    013070000
20511104            4.9      rho    011010000
*
20511200    dpup1     sum     1.e-3     0.         1
20511201    0.0     1.0    p 099010000
20511202           -1.0    p 016010000
20511203            4.993     rho    099010000
20511204            5.370     rho    016010000
*
20511300    dp034     sum     1.e-3     0.         1
20511301    0.0     1.0    p 099010000
20511302           -1.0    p 017010000
20511303           -4.9955     rho    099010000
20511304            13.867     rho    017010000
*
20511400    dpuhead   sum     1.e-3     0.         1
20511401    0.0    -1.0    p 018010000
20511402            1.0    p 019010000
20511403            0.7203      rho    019010000
20511404            2.19275     rho    018010000
*
20509600    dp12vp    sum     1.e-3     0.         1
20509601    0.0     1.0    p 035040000
20509602           -1.0    p 035050000
20509603           5.07       rho    035050000
*
20509700    dp22vp    sum     1.e-3     0.         1
20509701    0.0     1.0    p 045040000
20509702           -1.0    p 045050000
```

```
20509703          5.07       rho    045050000
*
20509800    dp32vp    sum     1.e-3     0.        1
20509801    0.0     1.0    p 055040000
20509802          -1.0    p 055050000
20509803          5.07       rho    055050000
*
20510200  dp22p      sum    1.e-3    46.7045    1
20510201  0.0        1.0      p 045050000
20510202           -1.0      p 047010000
20510203         -7.794      rho 045050000
*
20510300    dp22vg    sum     1.e-3     287.572  1
20510301    0.0     1.0    p 045040000
20510302          -1.0    p 045010000
20510303        -.579      rho 045040000
20510304        -2.8204    rho 045010000
*
20510500  dp32p      sum    1.e-3    46.7045    1
20510501  0.0        1.0      p 055050000
20510502           -1.0      p 057010000
20510503         -7.794      rho 055050000
*
20510600    dp32vg    sum     1.e-3     287.572  1
20510601    0.0     1.0    p 055040000
20510602          -1.0    p 055010000
20510603        -.579      rho 055040000
20510604        -2.8204    rho 055010000
*
20507000    dp51      sum     1.e-3     70.6971   1
20507001    0.0     1.0    p 043030000
20507002          -1.0    p 044010000
20507003         1.9213   rho 043030000
20507004         2.189    rho 044010000
*
20508000    dp61      sum     1.e-3     70.6971   1
20508001    0.0     1.0    p 053030000
20508002          -1.0    p 054010000
20508003         1.9213   rho 053030000
20508004         2.189    rho 054010000
*
20550000    dp4r2     sum     1.e-3     0.        1
20550001    0.0     1.0    p 061030000
20550002          -1.0    p 068010000
20550003           1.96    rho    068010000
20550004           4.41    rho    061030000
*
20550100    dp5r2     sum     1.e-3     0.        1
```

```
20550101    0.0     1.0    p 071030000
20550102           -1.0    p 078010000
20550103            1.96    rho    078010000
20550104            4.41    rho    071030000
*
20550200    dp6r2     sum     1.e-3    0.        1
20550201    0.0     1.0    p 081010000
20550202           -1.0    p 088010000
20550203            1.96    rho    088010000
20550204            4.41    rho    081030000
*
*********************************************************************
*  primary system masses
*********************************************************************
*
20515100   sgamas1  sum     1.0     99.3376  1
20515101    0.0     0.0350607       rho 034010000
20515102            2.068400e-3     rho 034020000
20515103            4.136800e-3     rho 034030000
20515104            6.205200e-3     rho 034040000
20515105            8.273600e-3     rho 034050000
20515106            1.034200e-2     rho 034060000
20515107            1.551300e-2     rho 034070000
20515108            1.551300e-2     rho 034080000
20515109            1.551300e-2     rho 034090000
20515110            1.551300e-2     rho 034100000
20515111            7.497950e-3     rho 034110000
*
20514100   sgamas2  sum     1.0     102.5563 1
20514112     0.0    7.497950e-3     rho 034120000
20514113            1.551300e-2     rho 034130000
20514114            1.551300e-2     rho 034140000
20514115            1.551300e-2     rho 034150000
20514116            1.551300e-2     rho 034160000
20514117            1.034200e-2     rho 034170000
20514118            8.273600e-3     rho 034180000
20514119            6.205200e-3     rho 034190000
20514120            4.136800e-3     rho 034200000
20514121            2.068400e-3     rho 034210000
20514122            0.0350607       rho 034220000
*
20515200   sgbmas1  sum     1.0     99.3376  1
20515201    0.0     0.0350607       rho 044010000
20515202            2.068400e-3     rho 044020000
20515203            4.136800e-3     rho 044030000
20515204            6.205200e-3     rho 044040000
20515205            8.273600e-3     rho 044050000
20515206            1.034200e-2     rho 044060000
```

```
20515207              1.551300e-2   rho 044070000
20515208              1.551300e-2   rho 044080000
20515209              1.551300e-2   rho 044090000
20515210              1.551300e-2   rho 044100000
20515211              7.497950e-3   rho 044110000
*
20514200  sgbmas2   sum     1.0     102.5563 1
20514212    0.0     7.497950e-3   rho 044120000
20514213              1.551300e-2   rho 044130000
20514214              1.551300e-2   rho 044140000
20514215              1.551300e-2   rho 044150000
20514216              1.551300e-2   rho 044160000
20514217              1.034200e-2   rho 044170000
20514218              8.273600e-3   rho 044180000
20514219              6.205200e-3   rho 044190000
20514220              4.136800e-3   rho 044200000
20514221              2.068400e-3   rho 044210000
20514222              0.0350607     rho 044220000
*
20516100  sgcmas1   sum     1.0     99.3376  1
20516101    0.0     0.0350607     rho 054010000
20516102              2.068400e-3   rho 054020000
20516103              4.136800e-3   rho 054030000
20516104              6.205200e-3   rho 054040000
20516105              8.273600e-3   rho 054050000
20516106              1.034200e-2   rho 054060000
20516107              1.551300e-2   rho 054070000
20516108              1.551300e-2   rho 054080000
20516109              1.551300e-2   rho 054090000
20516110              1.551300e-2   rho 054100000
20516111              7.497950e-3   rho 054110000
*
20516200  sgamas2   sum     1.0     102.5563 1
20516212    0.0     7.497950e-3   rho 054120000
20516213              1.551300e-2   rho 054130000
20516214              1.551300e-2   rho 054140000
20516215              1.551300e-2   rho 054150000
20516216              1.551300e-2   rho 054160000
20516217              1.034200e-2   rho 054170000
20516218              8.273600e-3   rho 054180000
20516219              6.205200e-3   rho 054190000
20516220              4.136800e-3   rho 054200000
20516221              2.068400e-3   rho 054210000
20516222              0.0350607     rho 054220000
*
20515300  cormas    sum     1.0     407.052  1
20515301    0.0     0.15323       rho 011010000
20515302              6.20907e-2    rho 012010000
```

```
20515303              4.70800e-3    rho 013010000
20515304              3.37264e-2    rho 013020000
20515305              3.33840e-2    rho 013030000
20515306              2.22560e-2    rho 013040000
20515307              3.33840e-2    rho 013050000
20515308              3.37264e-2    rho 013060000
20515309              1.80660e-2    rho 013070000
20515310              1.56310e-3    rho 014010000
20515312              1.11975e-2    rho 014020000
20515313              1.10838e-2    rho 014030000
20515314              7.38920e-3    rho 014040000
20515315              1.10838e-2    rho 014050000
20515316              1.11975e-2    rho 014060000
20515317              4.97350e-3    rho 014070000
20515318              5.03000e-2    rho 099010000
20515319              9.15640e-2    rho 015010000
*
20515400  vesmas      sum    1.0    361.04   1
20515401   0.0        .11263        rho 016010000
20515402              9.06700e-3    rho 017010000
20515403              4.90700e-2    rho 018010000
20515404              8.92590e-2    rho 019010000
20515405              4.33233e-2    rho 020010000
20515406              3.78310e-3    rho 021010000
20515407              2.44140e-3    rho 021020000
20515408              9.69700e-4    rho 021030000
20515410              2.39771e-2    rho 022010000
20515411              2.39771e-2    rho 022020000
20515412              2.39771e-2    rho 022030000
20515413              2.39771e-2    rho 022040000
20515414              7.51150e-3    rho 022050000
20515415              1.08295e-2    rho 022060000
20515416              2.79758e-2    rho 022070000
*
20515500  hlamas      sum    1.0    34.57254 1
20515501   0.0        1.305868e-2   rho 031010000
20515502              5.46800e-3    rho 032010000
20515503              8.724194e-3   rho 033010000
20515504              1.583533e-2   rho 033020000
20515505              6.021362e-3   rho 033030000
*
*
20515600  hlbmas      sum    1.0    34.57254 1
20515601   0.0        1.305868e-2   rho 041010000
20515602              5.46800e-3    rho 042010000
20515603              8.724194e-3   rho 043010000
20515604              1.583533e-2   rho 043020000
20515605              6.021362e-3   rho 043030000
```

```
*
*
20516600  hlcmas    sum    1.0     34.57254 1
20516601   0.0      1.305868e-2    rho 051010000
20516602            5.46800e-3     rho 052010000
20516603            8.724194e-3    rho 053010000
20516604            1.583533e-2    rho 053020000
20516605            6.021362e-3    rho 053030000
*
20515700  clamas    sum    1.0     108.3605 1
20515701   0.0      4.581000e-3    rho 035010000
20515702            2.123175e-2    rho 035020000
20515703            2.430950e-2    rho 035030000
20515704            8.967000e-3    rho 035040000
20515705            2.263400e-2    rho 035050000
20515706            2.062890e-2    rho 036010000
*20515708            8.921154e-3    rho 362010000
20515709            1.14828e-2     rho 037010000
20515710            9.394024e-3    rho 037020000
20515711            5.46800e-3     rho 038010000
20515712            8.57448e-3     rho 039010000
20515713            5.860165e-3    rho 039020000
*
20515800  clbmas    sum    1.0     108.3605 1
20515801   0.0      4.581000e-3    rho 045010000
20515802            2.123175e-2    rho 045020000
20515803            2.430950e-2    rho 045030000
20515804            8.967000e-3    rho 045040000
20515805            2.263400e-2    rho 045050000
20515806            2.062890e-2    rho 046010000
*20515808            8.921154e-3    rho 462010000
20515809            1.14828e-2     rho 047010000
20515810            9.394024e-3    rho 047020000
20515811            5.46800e-3     rho 048010000
20515812            8.57448e-3     rho 049010000
20515813            5.860165e-3    rho 049020000
*
20516800  clcmas    sum    1.0     108.3605 1
20516801   0.0      4.581000e-3    rho 055010000
20516802            2.123175e-2    rho 055020000
20516803            2.430950e-2    rho 055030000
20516804            8.967000e-3    rho 055040000
20516805            2.263400e-2    rho 055050000
20516806          2.06277890e-2    rho 056010000
*20516808            8.921154e-3    rho 562010000
20516809            1.14828e-2     rho 057010000
20516810            9.394024e-3    rho 057020000
20516811            5.46800e-3     rho 058010000
```

```
20516812            8.57448e-3     rho 059010000
20516813            5.860165e-3    rho 059020000
*
20515900  prsrmas   sum    1.0     114.4755 1
20515901   0.0      1.118650e-3    rho 090010000
20515902            9.040600e-3    rho 090020000
20515903            3.863750e-3    rho 090030000
20515904            2.161600e-3    rho 091010000
20515905            2.789000e-2    rho 091020000
20515906            0.187535       rho 091030000
20515907            0.187535       rho 091040000
20515908            2.424500e-3    rho 091050000
*
20519900  totmas    sum    1.0     1802.557 1
20519901   0.0      1.0   cntrlvar 151
20519902            1.0   cntrlvar 141
20519903            1.0   cntrlvar 152
20519904            1.0   cntrlvar 142
20519905            1.0   cntrlvar 153
20519906            1.0   cntrlvar 154
20519907            1.0   cntrlvar 155
20519908            1.0   cntrlvar 156
20519909            1.0   cntrlvar 157
20519910            1.0   cntrlvar 158
20519911            1.0   cntrlvar 159
20519912            1.0   cntrlvar 161
20519913            1.0   cntrlvar 162
20519914            1.0   cntrlvar 166
20519915            1.0   cntrlvar 168
*
20533000  tvesmas   sum    1.0      768.092 1
20533001   0.0      1.0   cntrlvar 153
20533002            1.0   cntrlvar 154
*
20530400   dp461c   sum   1.e-3    130.9371 1
20530401   0.0   1.0     p  060010000
20530402        -1.0     p  060050000
20530403       +0.49   rho 060010000
20530404       -4.1202 rho 060050000
*
20530500   dp462c   sum   1.e-3    129.352  1
20530501   0.0   1.0      p   060050000
20530502        -1.0      p   060060000
20530503       +4.1202   rho  060050000
20530504       +5.6408   rho  060060000
*
20530600   dp463c   sum   1.e-3    123.3542  1
20530601   0.0   1.0     p   060060000
```

```
20530602        -1.0     p   060080000
20530603      -5.6408  rho   060060000
20530604      -1.7756  rho   060080000
*
20530700   dp464c   sum   1.e-3   102.3876 1
20530701   0.0   1.0      p   060080000
20530702        -1.0      p   060090000
20530703      +1.7756   rho   060080000
20530704      +2.3642   rho   060090000
*
20530800   dp465c   sum   1.e-3   54.6744  1
20530801   0.0   1.0      p   060090000
20530802        -1.0      p   060100000
20530803      -2.3642   rho   060090000
20530804      -3.5537   rho   060100000
*
20530900   dp466c   sum   1.e-3   57.5067  1
20530901   0.0   11.124    rho   060100000
*
20531000   dp47   sum   1.e-3   185.7087 1
20531001   0.0   1.0      p   060100000
20531002        -1.0      p   062010000
20531003      -7.571    rho   060100000
20531004      +9.614    rho   062010000
*
20531100   dp050   sum   1.e-3   84.0194  1
20531101   0.0   1.0      p   021020000
20531102        -1.0      p   019010000
20531103       0.1092   rho   021020000
20531104      -1.369    rho   019010000
*
20531200   dp051   sum   1.e-3   146.4596 1
20531201   0.0   1.0      p   039020000
20531202        -1.0      p   019010000
20531204      -1.369    rho   019010000
*
20531300   dp052   sum   1.e-3   364.221  1
20531301   0.0   1.0      p   022060000
20531302        -1.0      p   039020000
20531303      +0.0896   rho   022060000
*
20531400   dp423t6   sum   1.e-3   724.238  1
20531401   0.0   1.0   p   034010000
20531402        -1.0   p   034110000
20531403      -2.189 rho   034010000
20531404       3.360 rho   034110000
*
20531500   dp433t6   sum   1.e-3   722.064  1
```

```
20531501   0.0   1.0     p    034220000
20531502         -1.0     p    034120000
20531503         -2.189 rho    034220000
20531504         +3.360 rho    034120000
*
20531600   dp4    sum    1.e-3     -33.6086  1
20531601   0.0    1.0     p    034220000
20531602         -1.0     p    034010000
20531603        -2.189   rho    034220000
20531604        -2.189   rho    034010000
*
20539900   dp523t6    sum    1.e-3    724.238  1
20539901   0.0    1.0    p    044010000
20539902         -1.0    p    044110000
20539903        -2.189 rho    044010000
20539904         3.360 rho    044110000
*
20533700   dp533t6    sum    1.e-3    722.064  1
20533701   0.0    1.0     p    044220000
20533702         -1.0     p    044120000
20533703         -2.189 rho    044220000
20533704         +3.360 rho    044120000
*
20532600   dp5    sum    1.e-3     -33.6086  1
20532601   0.0    1.0     p    044220000
20532602         -1.0     p    044010000
20532603        -2.189   rho    044220000
20532604        -2.189   rho    044010000
*
20533400   dp623t6    sum    1.e-3    724.238  1
20533401   0.0    1.0    p    054010000
20533402         -1.0    p    054110000
20533403        -2.189 rho    054010000
20533404         3.360 rho    054110000
*
20533500   dp633t6    sum    1.e-3    722.064  1
20533501   0.0    1.0     p    054220000
20533502         -1.0     p    054120000
20533503         -2.189 rho    054220000
20533504         +3.360 rho    054120000
*
20533600   dp6    sum    1.e-3     -33.6086  1
20533601   0.0    1.0     p    054220000
20533602         -1.0     p    054010000
20533603        -2.189   rho    054220000
20533604        -2.189   rho    054010000
*
*
```

```
20588800   corepow   function   1.e-3   0.0   1
20588801   time   0     1
*
20588900   masserr   sum   1.0   0.0   1
20588901   -2510.23  1.0   cntrlvar   199
20588902             1.0   cntrlvar   721
20588903             1.0   cntrlvar   722
20588904             1.0   cntrlvar   768
*
20500700   coredenf    sum   0.111111 746.84  1
20500701   0.0   1.0   rhof   011010000
20500702         1.0   rhof   012010000
20500703         1.0   rhof   013010000
20500704         1.0   rhof   013020000
20500705         1.0   rhof   013030000
20500706         1.0   rhof   013040000
20500707         1.0   rhof   013050000
20500708         1.0   rhof   013060000
20500709         1.0   rhof   013070000
*
20500800   coredeng    sum   0.111111 104.0   1
20500801   0.0   1.0   rhog   011010000
20500802         1.0   rhog   012010000
20500803         1.0   rhog   013010000
20500804         1.0   rhog   013020000
20500805         1.0   rhog   013030000
20500806         1.0   rhog   013040000
20500807         1.0   rhog   013050000
20500808         1.0   rhog   013060000
20500809         1.0   rhog   013070000
*
20501000   coredp      sum   0.10204   0.0   1
20501001   0.0   1.0   p   011010000
20501002        -1.0   p   013070000
20501003        1.715   rho   013070000
20501004       -52.038  cntrlvar   8
*
20501100   dendiff   sum   1.0   0.0   1
20501101   0.0   1.0   cntrlvar   7
20501102         -1.0   cntrlvar   8
*
20501200   corelvl   div   1.0   0.0   1
20501201   cntrlvar  11   cntrlvar  10
*
20501300   auxlvla   sum   1.0   13.45   1
20501301   11.255   0.158   voidf   061010000
20501302            0.7925  voidf   061020000
20501303            0.9     voidf   061030000
```

```
20501304            2.16    voidf   062010000
*
20501400   auxlvlb   sum   1.0   13.45   1
20501401   11.255   0.158   voidf   071010000
20501402            0.7925  voidf   071020000
20501403            0.9     voidf   071030000
20501404            2.16    voidf   072010000
*
20501500   auxlvlc   sum   1.0   13.45   1
20501501   11.255   0.158   voidf   081010000
20501502            0.7925  voidf   081020000
20501503            0.9     voidf   081030000
20501504            2.16    voidf   082010000
*
20590100   maxtempc   stdfnctn   1.0   0.0   1
20590101   max      httemp   13100108
20590102            httemp   13100208
20590103            httemp   13100308
20590104            httemp   13100408
20590105            httemp   13100508
20590106            httemp   13100608
20590107            httemp   13100708
20590108            httemp   13100808
20590109            httemp   13100908
20590110            httemp   13101008
20590111            httemp   13101108
20590112            httemp   13101208
*
20503400     feed1   sum   1.0   0.0   1
20503401     0.0   1.0   mflowj   601000000
20503402           1.0   mflowj   712000000
*
*
20503500     feed2   sum   1.0   0.0   1
20503501     0.0   1.0   mflowj   701000000
20503502           1.0   mflowj   714000000
*
20503600     feed3   sum   1.0   0.0   1
20503601     0.0   1.0   mflowj   801000000
20503602           1.0   mflowj   716000000
*
   * end of input
```

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11. ABSTRACT *(200 words or less)*

2" cold leg break test 9.1.b, conducted at the BETHSY facility was analyzed using the RELAP5/MOD3 Version 5m5 code.

The test 9.1.b was conducted with the main objective being the investigation of the thermal-hydraulic mechanisms responsible for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure.

The present analysis demonstrates the code's capability to predict, with sufficient accuracy, the main phenomena occurring in the depressurization transient, both from a qualitative and quantitative point of view. Nevertheless, several differences regarding the evolution of phenomena and affecting the timing order have to be pointed out in the base calculation.

Three calculations were carried out to study the sensitivity to change of the nodalization in the components of the loop seal cross-over legs, and of the auxiliary feedwater control logics, and of the break discharge coefficient.

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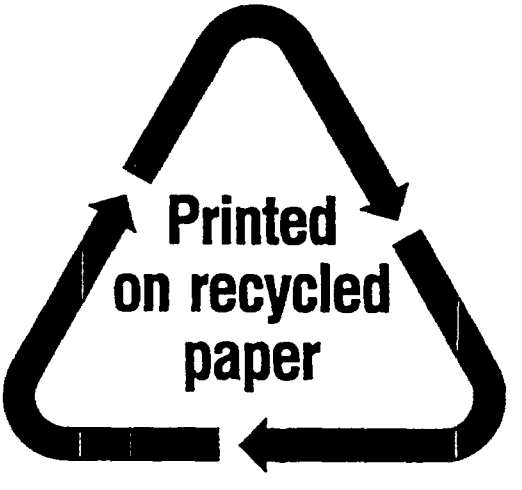

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